

THE BARNET BOOK OF PHOTOGRAPHY

NINTH EDITION. REVISED. INCLUDING NEW MATTER AND NEW ILLUSTRATIONS.

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BARNET, HERTS. MDCDVII.

PREFACE:

THE BARNET BOOK OF PHOTOGRAPHY has come to be recognised as a standard work. Its clear and concise instructions have made it a useful and practical guide to thousands of photographic workers, and, since first published in 1898, it has passed through several large editions which have met with an altogether unprecedented sale, until in 1905 it became necessary to reprint.

Although from time to time the articles and illustrations have been carefully revised and brought up to date, the production of the present edition has been taken advantage of to have the whole Book rewritten; new subjects have been introduced as the progress of photography required, so that the BARNET BOOK as now published became AN ENTIRELY NEW WORK, and this again in the present edition has been still further brought up to date.

We want THE BARNET BOOK to even more than ever remind Photographers throughout the world of our readiness to realise their needs, and to afford them help

and advice in a manner not perhaps usual with a commercial house; moreover, this BOOK should keep in remembrance that vast and growing industry whence Plates, Films, Papers, Carbon Tissues, etc., bearing the name of BARNET are sent forth.

That the Barnet productions are prepared only after the most painstaking scientific investigation and tests, and by means of all the great manufacturing resources of THE BARNET WORKS, sufficiently accounts for the ever-increasing demand made for them, to which it is our aim to respond in as full and liberal a manner as that in which the BARNET BOOK is planned.

We desire no monopoly, but are content with that measure of support which uniform good quality and fair prices must secure, and the record of the past leaves no room to doubt that our endeavours have been appreciated, and should, moreover, be a guarantee that the photographer of whatsoever rank can at all times confidently look to us for the material means of realising his Photographic Ideals, and for practical guidance in difficulties arising in the course of his Photographic Practice.

ELLIOTT & SONS, L^D.

BARNET, HERTS, 1906 

BARNET BOOK OF PHOTOGRAPHY.

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T is fair to assume that the reader of this book knows why the plate or film from which the completed photograph is printed is called a negative, and also that the negative is produced by first exposing a plate in the camera and subsequently developing it in a chemical solution ; but the beginner impatient to realise his results stays not to acquire a right understanding of those initial stages of the process, a knowledge of which would go far to ensure more uniformly successful results, instead of largely depending, as is so often the case, on mere luck or accident ; and whilst it may be too much to expect that the novice should be willing to delay his practice so long as to acquire an exhaustive knowledge of elementary principles, yet, could he be persuaded to devote just so much consideration thereto as shall give him something like a firm foundation to start with, and thus at a later stage have nothing to unlearn, it would be for his good, and it is the purpose of this article to give just so much of the process of negative-making that for the student to know less will leave him imperfectly equipped for future practice, whilst fuller information may not be essential, though, if thought desirable, may be derived by the study of more exhaustive treatises combined with practice.

Many, though of course not all, of my readers would find it difficult to say precisely how they learnt what they know of photography. They began by placing a plate in the camera according to directions, exposed it for a period of time, not determined by anything more reliable than a guess, and subsequently poured over it a developing solution, and accepted what the Fates gave. No very definite idea was formed from this and similar first attempts, except that particular plates came out all right and others didn't. But why this was so remained for want of a little previous knowledge quite unanswered; and instead of being able to deliberately repeat the conditions which secured success, the lesson which experience should have taught was lost. Even now perhaps the reader is by no means certain of securing even a majority of successful negatives from every batch of exposed plates, and, like a spendthrift, would be astonished were an account rendered of the plates and time wasted in producing those failures which he so readily forgets in the gratification which his few almost accidental successes give him.

Surely, if the careful perusal of a few printed pages will give the beginner greater assurance, certainty and economy, it were worth doing.

Negative-making may be conveniently considered under three headings—exposure, development and after-treatment, and will here be briefly so treated.

EXPOSURE.

On the principle of "safe bind, sure find," the more care that is exercised in securing an approximately correct exposure, the simpler and more satisfactory will all subsequent operations become. In ascertaining the correct exposure in any given instance, six points have to be considered:—(1) The speed of the plate. (2) The character of the subject. (3) The light. (4) The time of year. (5)

The time of day. (6) The aperture of the lens.

For general purposes we may regard plates and films as being of four kinds, differing from each other in respect to their speed or light sensitiveness. These are :—Slow or ordinary, medium, extra rapid, and specially rapid ; the three first-named being, roughly speaking, each twice as rapid as the one coming before it. The specially rapid is usually known under some fancy name, according to the maker, as, for instance, "Rocket" or something similar, and is, perhaps, half as rapid again as the extra rapid. Now, it stands to reason that what is a correct exposure for, say, "ordinary" plates will be too long for "medium," and still more so for "extra rapid." Next we have the character of the subject, and it should hardly need explanation to show that if one second be the right exposure for an open sea view in which there is no dark object, and which indeed is so bright as to make one's eyes ache, then it will not be sufficient for a woodland scene, which we value for its very dimness and cool shade. Remember that the plate in the camera is affected by the light reflected from the scene through the lens, and near objects reflect less than remote ones ; hence distance is, generally speaking, lighter than objects near at hand. The sky is the lightest part of every view, whilst at the other end of the scale would be indoor scenes where the sky is intercepted by the roof, and light only admitted by windows and doors.

The next three factors—the light, the season and the hour—may be considered together presently, and next we have the lens aperture.

Your lens, unless it be of a very cheap kind, is furnished with the means of altering the size of the opening, the chief purpose of which is to increase the defining power of the lens, a matter which does not concern us for the moment, and which will be better understood by refer-

ence to Mr. Welborne Piper's article on lenses in another part of the book; but altering the aperture incidentally affects the amount of light which enters the lens, hence, the smaller the "stop" or aperture, the longer must the exposure be in order to admit more light, and the stops are so made that each aperture admits double the volume of light admitted by the next smaller, and consequently only requires half the exposure to be made. It may be explained that the stops are usually marked *f*/8, *f*/11, *f*/16, and so on,* these signs meaning that the diameter of the aperture is $\frac{1}{8}$th, $\frac{1}{11}$th, or $\frac{1}{16}$th, etc., of *f*, which stands for the focal length,—that is the distance between the plate and the lens when the scene is sharply focussed.

So now we have three factors towards calculating the exposure for any particular scene—the speed of the plate, the aperture of the lens, and the lightness or darkness of the scene itself. If you explain in general terms the nature of your subject and state the plate and lens aperture you propose to use, it might be expected that a person with a little experience would tell you about what exposure to give, and indeed a table of exposures can be made out for your guidance, such a one being given below; *but* throughout the year and in every hour of each day the power of the daylight is changing, and this has to be taken into consideration. From midwinter to midsummer the light gradually increases and then as gradually declines in power, and so in each day from dawn to noon the light grows in intensity, and then falls off again towards sunset. In the Northern Hemi-

* To avoid confuison it may be said that in some cases for greater accuracy the stops are marked in decimal fractions, thus: *f*/8·6, *f*/11·31, etc., or a different series of numbers are taken; the relative exposures, however, remain the same, each larger stop requiring half the exposure of the next smaller, so that, the right exposure being found with any one stop, that with another is ascertained by multiplication or division.

sphere, then, midsummer at noon represents the maximum light power, and so tables of approximately correct exposures are calculated as for noon sunshine in midsummer, and must be increased proportionately as the time of day and year are removed therefrom. Such a table is here given, in which some typical classes of subjects are set down; but if the subject does not appear to come within this classification a little independent judgment must be exercised, whilst if a smaller or larger stop is used multiplication or division by 2 of the exposures given for the next larger or smaller stop respectively must be made. The exposures below are given in seconds or fractions of seconds.

EXPOSURE TABLE.

Exposure required to give Bright Crisp Negatives with the Developing Formula given on the Plate Boxes. In Bright Sunshine in June, mid-day.

Stop	Plate	Bright Clouds and Sky.	Sea-scapes and Extreme Distance.	Open Land-scapes	General Views with Dark Objects in Fore-ground.	Figures, Groups, and Build-ings near to	Portrait in well-lighted Rooms and light interiors.
F/11	Ordinary ..	$\frac{1}{125}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{4}$	$\frac{1}{3}$	15
	Medium ..	$\frac{1}{250}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{8}$	$\frac{1}{6}$	8
	Med. Ortho	$\frac{1}{250}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{8}$	$\frac{1}{6}$	8
	Ex. Rapid	$\frac{1}{300}$	$\frac{1}{120}$	$\frac{1}{65}$	$\frac{1}{16}$	$\frac{1}{12}$	4
	Ortho .. Ex. Rapid	$\frac{1}{500}$	$\frac{1}{120}$	$\frac{1}{60}$	$\frac{1}{16}$	$\frac{1}{12}$	4
	Red Seal ..	$\frac{1}{850}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{28}$	$\frac{1}{20}$	7
F/16	Ordinary	$\frac{1}{60}$	$\frac{1}{15}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	30
	Medium ..	$\frac{1}{125}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{4}$	$\frac{1}{3}$	15
	Med. Ortho	$\frac{1}{125}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{4}$	$\frac{1}{3}$	15
	Ex. Rapid	$\frac{1}{250}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{8}$	$\frac{1}{6}$	8
	Ortho .. Ex. Rapid	$\frac{1}{250}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{8}$	$\frac{1}{6}$	8
	Red Seal ..	$\frac{1}{420}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{14}$	$\frac{1}{10}$	4
F/22	Ordinary	$\frac{1}{30}$	$\frac{1}{8}$	$\frac{1}{4}$	1	$1\frac{1}{2}$	60
	Medium ..	$\frac{1}{60}$	$\frac{1}{15}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	30
	Med. Ortho	$\frac{1}{60}$	$\frac{1}{15}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	30
	Ex. Rapid	$\frac{1}{125}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{4}$	$\frac{1}{3}$	15
	Ortho .. Ex. Rapid	$\frac{1}{125}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{4}$	$\frac{1}{3}$	15
	Red Seal ..	$\frac{1}{300}$	$\frac{1}{50}$	$\frac{1}{25}$	$\frac{1}{7}$	$\frac{1}{5}$	8

These Exposures are on the H. and D. Actinograph Basis.

Almost any text-book of photography will give you exact tables showing the alteration of the light at different hours and seasons; but for the present purpose it may be sufficient to say double the exposure in March and April, and also in August and September, quadruple it from early November to end of January; and, as regards time of day, double the noon exposure at 9 to 10 A.M. and 2 to 3 P.M. increasing it to from four to six times when near to sunrise or sunset.

One more consideration remains, and that is the state of the weather. If the sun be lightly clouded over, double the exposure; if dull and cloudy, multiply it by three; or if very gloomy four or five times the normal exposure will not be too much.

Now there is nothing really complicated in all this. Our table gives us a clue to start with, and then we increase the time there given according to the season, hour and weather.

But if any hesitation be felt, an actinometer, or exposure meter, can be resorted to, a little instrument which contains a light-sensitive strip of paper. This is placed in a shady part of the subject, and the time the paper takes to darken under the influence of the light is counted in seconds, and by then adjusting certain series of figures representing those factors which have been described above the required length of exposure is automatically given. There are many contrivances of this kind, including sliding scales to assist in calculating, but perhaps the best course is to work out the exposure yourself as above directed, and then seek by using an exposure meter to corroborate your own estimate. In this way, after a very little time, what may appear now as a laborious arithmetical exercise comes intuitively. Do not let the six factors and the columns of figures dismay you. Put *F* 16 stop in the

lens, choose an open landscape subject, use a medium plate, refer to the table on page 13. In the third column, sixth line from the top, your read $\frac{1}{15}$th of a second; but suppose it is in March, then double $\frac{1}{15}$th, which is, say, $\frac{1}{8}$ second, and if it be afternoon, 3 P.M., then double it again, which gives $\frac{1}{4}$ second if the sun is shining, and if the sun is clouded double or triple the time—that is, from $\frac{1}{2}$ a second to one second according to whether the sky be lightly clouded over or quite dull.

But the reader may have a question to ask as to which of the four speeds of plates to use. This must be largely decided by circumstances; but at the outset, or until he has learnt to get fairly accurate exposures, he will do best by keeping to the "happy medium," and except on some special occasions the medium plate will be fast enough for almost any purposes, and more easy to manipulate than a very rapid one, which should be regarded by the beginner rather in the light of an emergency plate. Moreover, by keeping to one speed of plate one factor in the calculation remains the same.

In very dull winter weather, however, an extra rapid plate will prove useful, compensating somewhat for the feeble light; whilst in bright summer days an "ordinary" or comparatively slow plate will be fast enough. And now, having exposed a plate, we proceed to develop the at present invisible or latent image.

DEVELOPMENT.

Although there is a great variety of developers, they all consist essentially of three elements—(1) The developer proper or *reagent*; (2) an alkali, the addition of which sets the reagent going, and as the quantity is increased quickens its action, and is hence called the *accelerator*; and (3) bromide of potassium or bromide of ammonium, which retards action, and is called the *restrainer*. These may be made up in three separate

solutions, and by using a little of this and a little of that development may be accelerated or retarded as the progress of affairs may suggest as desirable. But perhaps we are not experienced enough to profit by this opportunity of controlling the development, and hence it will be best to use a formula in which due proportions of all three are mixed together, thus giving only one solution.

Here is one such formula, which is easily made up, or if preferred a ready-made one-solution metol-hydroquinone developer, may be procured :—

Metol	200 grains,	or 6 grammes
Water..	80 ounces,	or 1,000 c.c.
Sodium sulphite ..	6 ,,	or 75 grammes
Hydroquinone ..	150 grains,	or 4 ,,
Potassium bromide ..	50 ,,	or 1¼ ,,
Potassium carbonate	2 ounces,	or 25 ,,

The ingredients had better be dissolved in turn in the order given, using hot water to begin with, but using the mixed developer only when quite cold.

Although we have now made a "one-solution" developer, yet it is a good plan to have always ready in addition a ten per cent. solution of potassium bromide —that is, one ounce of potassium bromide dissolved in ten ounces of water. This should be a stock item, always ready on a shelf, close at hand to the developing table.

It need not, of course, be said that, our solutions being ready, white light is excluded from the room, and the dark-room lamp, of whatever form that may be, is alone used.

Placing the plate in a suitable developing dish, having previously lightly wiped the surface with a silk handkerchief or the soft part of the hand, provided the hand is dry and clean—this being done in order to remove any particles of dust on the surface—sufficient developer is taken in a glass measure or similar vessel to cover the plate when poured over it.

And here I am going to make a suggestion which is the out-come of experience, and it is this, that, if we take four fluid ounces of developer, we add thereto one to two ounces of plain water, thus diluting it in strength. The formula given above is a standard stock solution, but it is very energetic and it may be found safer to weaken it a little. The same suggestion applies to ready-made developers, the instructions with which tell you to take, say, one part to four parts of water, in which case I should take five or six parts of water. The reason for this dilution may appear presently.

Now pour the contents of the glass measure over the plate in one even continuous wave, and—here let it be said that to take too little of the solution is a false economy—there should be enough of it to well cover the plate when at rest, and a sharp look-out must be kept that after flowing no corner or edge of the plate remains uncovered, also that no bubbles have formed ; a touch with the finger will disperse the latter, and then the dish is gently rocked so as to keep the developer slightly moving. The result of an uncovered patch may not and probably will not be revealed until the negative is finished, and then appears as an irregular thin area which nothing can rectify ; similarly, a bubble prevents the developer acting on the plate by interposing a tiny dome of air, and this will produce a semi-transparent circular spot.

Rocking the dish and watching the plate during the first half minute or so will be an anxious period, and if exposure has been correct and no error unwittingly committed there will presently appear a darkening of the film here and there in more or less well-defined areas. These represent those portions of the scene where the light has been strongest and has affected the plate most. These should rapidly blacken ; meanwhile other parts

in turn darken, not in very quick succession, but with due precision. We know now that exposure has been correct, and each part of the view has duly impressed the plate according to its relative lightness ; but suppose we find that very soon after the developer is flowed on, the whole of the plate darkens, or after the first dark area appears the other parts follow very rapidly, then it is evident that the plate is over-exposed.

After a little experience has been gained at this sort of thing, such a plate may perhaps be saved by at once pouring off the developer back into the measure, instantly flooding the plate with water to stop further action, adding a few drops of the bromide solution to the developer and beginning over again ; the bromide restraining the developer's action, and giving what will eventually be the densest parts of the negative time to gather density before the others. With the developer made up as above, this course is not perhaps to be recommended, because it will be seen that the formula already includes bromide, and we may easily get an excess of it ; but the addition of bromide to retard the action is mentioned here to illustrate a principle which applies more particularly with some other developers to be given later.

If, on the other hand, after the first darkening, the remainder of the film shows no sign of following on, and the first dark area, probably representing the sky, grows black with a well-defined edge to it, then we may recognise the evidence of under-exposure. The sky, always so luminous as to impress a plate in a fraction of a second, has had its effect, but the terrestrial objects, reflecting much less light, have not had sufficient time, and for an under-exposed plate there is practically no salvation.

Supposing, however, that the exposure has been

approximately correct, we shall next want to know when to stop development. Perhaps the most practical course at first will be to procure, if possible, a good or fairly good finished negative, and cover it with two or three thicknesses of fine tracing-paper. As soon as that portion of your plate which has darkened has assumed a fairly deep tint, lift it out and hold it so that you can look through it towards the dark-room lamp, and hold the paper-covered pattern negative by its side. With a fully-exposed and fully-developed plate there still remains a certain thickness of film which is unaffected and deprives the plate of a certain degree of transparency, and I have suggested the tracing-paper addition to the clear finished model negative as something like an equivalent ; but you have not to compare the general transparency of the two so much as the relative intensities of the various parts. If the darkest part of your plate seems less dense than the darkest part of the model, return it to the developer, being careful that no bubbles are formed, and that the solution thoroughly covers the surface. After a minute or so examine it again, and if you are uncertain perhaps this plate had better be used purely experimentally, so rinse it in water and place it in the fixing bath made as follows:—

Hyposulphite of soda	6 ounces
Water	12 „

To which when dissolved add—

Metabisulphite of potassium ..	1 ounce
Water	10 ounces

Or an alternative is—

Hyposulphite of soda	6 ounces
Water	12 „

When dissolved add to it—

Sulphite of soda	2¼ ounces
Tartaric acid	2 „
Water	8 ..

Both these are what are known as acid fixing-baths,

and are much pleasanter to use than the old-fashioned and still largely employed plain hypo bath, consisting of 4 ounces hyposulphite of soda in 20 ounces water.

After a few minutes' immersion the opalescent appearance at the back of the negative will have disappeared; leave the plate therein for yet another five minutes, and then wash in water.

You have now your finished negative, and it may be examined by daylight and compared with your model with its tracing-paper removed. If it is too dense it has been developed too long; if too thin, not long enough. Try now and recall its appearance when examined by the dark-room lamp, and, remembering this, try and profit by the experience in future.

A much simpler but not less important operation remains. The finished negative must be left in running water for not less than an hour and a half to two hours, or, if the water supply be limited, it should receive ten changes of water with an interval of five minutes' soaking between the changes, and then be set on end to dry in an airy place free from dust.

VARIOUS DEVELOPERS.

We may now briefly review some of the many developers which are at our disposal, each possessing some more or less distinctive characteristic, yet all being dependent on the same principles.

First we have a developer somewhat similar to the one already given, but in two separate solutions.

SOLUTION No. 1.

Water..	20 ounces,	or	1,000 c.c.
Sodium sulphite ..	2 ,,	or	100 grammes
Hydroquinone ..	160 grains,	or	18 ,,
Citric acid	60 ,,	or	6 ,,
Potassium bromide ..	30 ,,	or	3 ,,

SOLUTION No. 2.

Water..	20 ounces,	or	1,000 c.c.
Caustic soda	160 grains,	or	18 grammes

These are to be kept in separate bottles, and labelled No. 1 and No. 2. Were we sure that the exposure is correct we should merely take equal parts of each and flow the mixture over the plate; but to guard against over-exposure taking us by surprise and the whole plate darkening before we can apply a remedy, we will first take, say, 3 ounces of as much as will comfortably cover the plate of No. 1, and add to it only 1 ounce of No. 2. Pour this on, rock the dish and watch.

Should no darkening occur after half a minute or so, pour the developer back into the measure, add another ounce of No. 2 and try again, and after another minute we may in like manner add the third ounce of No. 2, thus making the developer up to normal strength.

If, now, the image should seem to hang fire, pour the developer off; add to its own bulk of water, and half an ounce, or in extreme cases 1 ounce, more of No. 2 and proceed as before.

We are now employing the alkaline solution No. 2 as an *accelerator*, having added water to prevent the whole solution being too strong

Another standard developer of the same class is as follows:—

No. 1.

Water	10 ounces,	or 1,000 c.c.
Potassium metabisulphite	35 grains,	or 7·5 grammes
Ortol	70 ,,	or 15 ,,

No. 2.

Water	10 ounces,	or 1,000 c.c.
Potassium carbonate ..	½ ounce,	or 60 grammes
Sodium sulphite	1¾ ounces,	or 180 grammes
Potassium bromide ..	5 grains,	or 1 gramme

As in the previous case, equal portions of each are to be taken for normal use or modified as before and used tentatively.

One more developer of the kind may be given, which,

if a little more difficult to use at first on account of its extraordinary rapidity, is exceedingly useful when once mastered; this is Rodinal. Rodinal is sold as a solution ready made, and needs only to be diluted to be ready for use, the proportions being from 1 to 20 parts to 1 to 70 parts of water. With this the 10 per cent. solution of bromide of potassium is very useful, as, owing to its extremely energetic character, the image often flashes up in a rather disconcerting manner.

Now, with all the developers thus far mentioned, the same portion of solution can be used repeatedly—that is, for several negatives in succession,—provided the proportions are right—and they do not produce a stain on either the fingers or the plate. To the same class belong a number of other more or less modern introductions such as Edinol, Amidol, Eikonogen, Kachin, Glycin, Synthol, etc. But many practitioners still remain loyal to the older-fashioned pyrogallic acid or pyrogallol, the brownish stain which it imparts to the film being considered by some as an advantage in printing. Two formulæ are here given in which carbonate of soda and ammonia are respectively used as the alkali :—

PYRO AND SODA DEVELOPER.

No. 1.

Water	80 ounces,	or 1,000 c.c.
Nitric acid..	20 drops,	or 5 c.c.
Pyrogallol	1 ounce,	or 12 grammes
Potassium bromide ..	60 grains,	or 2 ,,

No. 2.

Water	80 ounces,	or 1,000 c.c.
Sodium sulphite	9 ounces,	or 112 grammes
Sodium carbonate (clear crystals)	8 ounces,	or 100 ,,

For an ordinary developer equal parts of No. 1 and No. 2 are taken, or the potassium bromide may be used as a separate solution and used as required. The other formula is :—

PYRO AND AMMONIA.

No. 1.

Water	20 ounces,	or 1,000 c.c.
Potassium metabisulphite	1 ounce,	or 120 grammes
Potassium bromide ..	½ ounce,	or 60 ,,

When dissolved add :—

Pyrogallol	1 ounce,	or 120 grammes

No. 2.

Water	8 ounces,	or 800 c.c.
Ammonia, ·880	2 ounces,	or 20 c.c.

For use take 1 dram of each to from 4 to 6 ounces of water, but until the condition of the plate as regards exposure is ascertained it will be best to take 1 dram of No. 1 and ½ dram of No. 2 to 6 ounces of water, adding the other ½ dram of No. 2 as it may seem desirable.

For a pyrogallic developer this gives a minimum amount of stain and works slowly.

Some other developing formulæ are given in the article entitled "Some Useful Formulæ" (p 271).

DENSITY.

One occasionally hears the complaint that such and such a plate or formula will not give sufficient density ; but it should be borne in mind that density can always be obtained if the plate be left long enough in the developer, but a slightly over-exposed plate may quickly darken on the surface and appear nearly opaque when examined by transmitted light, but will prove after fixing to be much too thin. Indeed, developers vary a good deal in the *apparent* density shown before fixation ; hence the desirability of adhering rigidly to one developer and always judging the progress of development by one and the same light, so that one's judgment may not be misled by the specific variations of different developers or the greater or less intensity of the light.

SOFTER EFFECTS.

It is quite a common fault to develop negatives too much, so that they yield a print of a kind commonly dubbed "soot and whitewash," on account of the harsh whiteness of the high-lights and the impenetrable blackness of the shadows. Formerly, the ideal negative was held to be that which was all but solid or opaque in those parts representing the highest lights and clear transparent film in the deepest shadows; but closer observation and a better understanding of Nature have revealed the fact that, unless it be in some very small spot indeed, pure white and jet black in a print are inartistic and unnatural; but with most standard developers such as those given above it is probable that before the least affected parts have yielded to the developer the highest lights have accumulated such deposit as to have become quite or nearly opaque, and hence the recommendation given earlier in this chapter to dilute the developer with a larger proportion of water, for with this the negative is very slow to gain density, whilst detail still continues to come up in the shadow parts, and a softer, more delicate negative is the result.

Of the fixing bath, which has already been mentioned and formulæ given, nothing more need be said.

WASHING AND DRYING.

The above heading suggests operations of such simplicity as to require no special description, yet it is not too much to say that these commonplace performances properly carried out are in their way as essential as any part of the procedure. Hyposulphite of soda in solution has, in the course of fixation, permeated every part of the soft gelatinous film, and the subsequent washing must be of such a kind that not a trace shall remain; and the only sure way to accomplish this is to leave the plate, if

possible, in a vertical position for two hours in a constantly flowing stream of water. Metal troughs may be obtained with grooves to hold the plates vertically, from which the contaminated water passes out at the bottom as fresh water flows in from a supply-tap left running ; or, if water be limited, it may be sufficient to soak the plate in water, changing the water ten or a dozen times during an hour, at intervals of, say, five minutes. Nothing is so sure to bring its own punishment as careless or imperfect washing of a negative, for in a day or two, or perhaps not for a week or more, the hypo left in the film begins to crystallise on the surface, and nothing can cure or restore it.

Prescriptions are given for the elimination of hypo by chemical means ; but water, and plenty of it, is the best eliminator, and the reader is not recommended to try any other as yet.

After the long immersion in fluids it will be understood that the gelatine film is in a very sodden condition, and in warm weather it may be necessary to have recourse to a few minutes' immersion in a saturated solution of alum to prevent the film from partially dissolving and leaving the glass altogether ; but in any case more than trivial attention should be given to secure as rapid drying as possible. Ordinary drying racks sold for the purpose often prove pitfalls, the plates being so close together than unless a vigorous draught of air be available some portions will occupy a most unnecessary time, and it is just this unequal drying which must be avoided. Perhaps the readiest means is to lay along the top of a shelf a strip of blotting-paper folded to two or three thicknesses, and, having allowed the water to drip from the plate, stand it on end on the blotting, and let it rest against the wall at the back of the shelf, film side outwards ; or, better still, French wire nails may be driven

into the wall, between two of which a plate may rest cornerwise. In damp weather, when the atmosphere does not encourage rapid drying, it will be wisest to soak the plates in methylated spirit for a quarter of an hour before drying; they will then dry in ten minutes.

FACTORIAL OR TIME DEVELOPMENT.

No article on negative-making or extended reference to development would to-day be complete without including at least a brief explanation of what is termed time development, a system introduced more than ten years ago by Mr. Alfred Watkins, whose arguments in its support are so difficult to controvert that, although there are many, particularly amongst older workers, who dispute its efficacy, it may be confidently recommended to the beginner, who, having once mastered its simple rules, will find that they more surely guide him to success than if he relied on his own unripe judgment and unskilled eye. Even the expert, deceived perhaps by appearances, will occasionally allow the plate to remain too long in the developer or will remove it too soon; but in time or factorial development we have a simple arithmetical formula whereby to solve that always difficult problem, "when to stop development."

In the following brief description of time development it may strike the student that there are some points which are in conflict with the teachings of what has already been said with reference to modifying or controlling the development, and these points have given rise to frequent controversy. This, however, need not concern the reader. He may choose either the older tentative method, as already described, or the newer style of determining development by factors, without troubling to make them agree. Instructions for both are given him in this article; but if the reader's experience be but slight he will do well to forthwith adopt the

"time" method, and he will learn that success is easier to attain by learning and applying a fixed rule than by depending on personal judgment.

In the instructions already given for development it was stated that by modifying the constituents of the developer the degree of density, etc., could be controlled; on the other hand, it may be shown that—

(*a*) All developers have equal power in bringing out detail if the plate be left long enough; the addition of bromide merely delays it.

(*b*) All developers are nearly equal in density-giving power if only development be continued long enough. Exception may have to be made in the case of a developer like pyro, which gives a coloured image or stain in addition to the ordinary black deposit, thereby producing an increased density.

(*c*) When comparing similar exposures treated in different developers if each is taken out when the highest light—that is, the greatest density—is alike in the two, every other tone will also be exactly equal provided that the time has been long enough to bring out the lowest tone in each. (Large variation in the amount of bromide would affect the principle).

Here are three fundamental principles which the reader may accept without attempting to verify, and Mr. Watkins insists that the addition of bromide or the reduction of the proportion of alkali only affects the formation of gradation if the alteration is made *before* the developer is poured on, the only power of control over contrast or density being the length of development. He urges that all photographers employ this power even when they think they exercise other means. A man wishes to get thinner negatives with less contrast than he has been getting, so uses a dilute developer and

develops for his accustomed time. He gets his desired result, but puts it down to a special virtue in the weak developer, whereas he would have secured the same result if he had only taken the negative out a little earlier. The broad rule, then, is *longer development, greater contrast.*

Now, the main principle on which time development is based is this, that any change of temperature (and temperature affects development to a marked degree), or any change in the amount of alkali which lessens or increases the time required to obtain a certain degree of density or contrast also alters in exactly the same ratio *the time which elapses before the first darkening of the plate begins,* so that, if we once ascertain that the time required for full density is so many times the period which elapses before the first appearance, then the plate may be always developed for a given multiple of the time of appearance, and a standard amount of contrast will always result. This multiple is called the multiplying factor.

We proceed, then, as follows :—

The developer being mixed, place the plate in the dish, and at the moment the hand of your watch touches an even minute pour the developer on and rock the dish ; the moment the high-lights appear on the creamy surface note the time.

The time that has elapsed between pouring on and the first appearance is the time of appearance, and this multiplied by the multiplying factor gives the tota time of development.

To take an example. Suppose we are using the metol-hydroquinone developer given on page 16, and suppose also that the multiplying factor which will give the amount of contrast we require to be 14. Again, let it be supposed that between pouring on the developer and the first darkening of the high-lights 20 seconds elapses,

then 20×14 will give 4 minutes 40 seconds, and when development has proceeded for 4 minutes with absolute confidence that development is complete, without the necessity of examining the negative, it is taken out, rinsed and passed into the fixing bath. If with the next plate the image should appear more quickly, say, in 10 seconds, then, multiplying this shorter time of first appearance by 14, we get 140 seconds, or 2⅔ minutes, which will be the total time of development to attain the same density as the previous more slowly appearing negative attained. On the other hand, suppose we desire another plate to possess more contrast, we increase the multiplying factors say, from 14 to 20 and multiply the time of appearance by that.

This system of timing development is not dependent on any particular developer, and, so long as we do not use one in which the formation of density does not follow very closely on the bringing out of detail, it matters little what developer is used.

Developers vary widely in one respect, and that is the rapidity with which density follows detail ; and hence in the list of typical multiplying factors given below it will be seen that they vary as much as from 3¼ to 40. In one class of developing agents, such as metol, rodinal and amidol, the image and all detail appear very early in the course of development, density being attained comparatively slowly. Hence this class are commonly regarded as not giving sufficient density or contrast, simply because the user does not leave the plate in long enough. The multiplying factors for these are, with average formulæ, 28, 40 and 18 respectively, high multipliers giving a long time for total development.

In the second class, represented by hydroquinone, pyro and adurol, the lowest tones or detail appear quite slowly, and by the time they have appeared the

high-lights have attained considerable density, sufficient contrast then being attained quite rapidly ; hence a low multiplying factor gives a sufficiently long total time for development. It is with this class of developers that bromide has most power, for the restrainer is able to hold back the lower tones until the upper ones have full density, and if the plate be taken out at this stage the bromide has altered gradation to a considerable extent. The most convenient developer for time development will be neither extreme of these classes, but one with a medium multiplying factor, and in which density follows the first appearance at a comfortable rate.

The figures given below have been worked out by Mr. Alfred Watkins as a guide, and represent the multiplying factors of the majority of developers in use, or the ratio between time of appearance and the attainment of a desired amount of contrast or density. They must of course be varied according to the photographer's ideal as to the desirable degree of density, or for the particular character of negative required by circumstances :—

Developer	Factor
Pyro soda—	
1 grain per ounce and ¼ grain bromide	9
2 ,, ,, ,, ½ ,, ,,	5
3 ,, ,, ,, ¾ ,, ,,	4½
4 ,, ,, ,, 1 ,, ,,	4
8 ,, ,, ,, 2 ,, ,,	3¼
Hydroquinone	5
Adurol	5
Eikonogen	9
Metol	28
Glycin	7
Amidol (2 grains)	18
Pyro-metol	14
Rodinal	40
Metol-hydroquinone	14
Ortol	14
Diogen	12
Kachin	9

It will be clear that in the dim light of the dark-room

the figures on one's watch dial may not be very easily read, and hence a special clock, called an eikronometer, may be employed, in which a single hand goes round the dial once in 10 minutes. The minute divisions are very large and are plainly marked; a simple sliding scale or calculator multiplies the appearance by the factor, and points to the total time of development.

A modification of the factorial method is known as the sextuple method, in which the factor 6 is adhered to throughout, and the developer diluted so as to make the time of appearance suit the factor 6, but sufficient has now been said to put the beginner in the way of using factorial development, and he may, if need be, refer to Mr. Watkins' "Manual" for any further particulars.

AFTER-TREATMENT OF NEGATIVES.

Whilst a negative which has had its faults set right by subsequent chemical treatment is not to be preferred to one which needs no doctoring, it is often imperative that we should use any power within our reach to improve and make the best of an unsatisfactory negative. The two chief processes under this heading are intensification and reduction, and for the purposes of the present article it will be sufficient if a few formulæ and their use be given in the briefest manner.

INTENSIFICATION.

A negative which has been taken from the developer too soon may be described as thin, weak, or flat—that is, lacking in sufficient contrast between the parts representing the lights and those corresponding to the shadows, and the print it will yield will possess a dull, foggy appearance; hence we seek to add some fresh matter to the image to increase its substance and light resisting power.

Intensification may take place immediately the negative is finished or at any subsequent time, but it is important that the plate should have been thoroughly fixed and very thoroughly washed. If the negative be dry, it had better be soaked in water for half an hour.

Immerse the plate in the following solution :—

Mercury bichloride	5 parts
Hydrochloric acid	1 part
(or Ammonium chloride	5 parts)
Water..	100 parts

The film will gradually become bleached, first turning grey and then milky white. Occasionally rock the dish. Now remove the plate, and wash thoroughly in running water for two hours.

The bleached image is next blackened by immersing in—

Ammonia ·880	1 part
Water..	20 to 30 parts

Or a weak metol developer, or a 10 per cent. solution of sodium sulphite may take the place of the ammonia solution. As soon as the blackening has penetrated through to the back of the plate, which will be in a few minutes, the plate is washed and dried, when it will be found that it has gained considerably in intensity. The first or ammonia method secures a greater degree of intensification, but the results are not always to be relied on as permanent. Sodium sulphite is not such a powerful blackener, but in any case the operation may be repeated from the beginning to gain increased intensification.

Another method is to "stain" the image a reddish colour with a deposit of uranium, which greatly increases its light-resisting power :—

Uranium nitrate	1 part
Water..	50 part
Glacial acetic acid	1 part
Potassium ferricyanide	1 ,,

Immerse the negative in the above, and, as soon as it



A HAUL OF PILCHARDS
By HUBERT [illegible]

Taken on [illegible]

is judged to be sufficiently "browned," remove and rinse in water to which a drop or two of acetic acid have been added, and then wash under the tap until the stain is removed from the more transparent parts. If the water is at all alkaline, as most house water is, the whole of the intensification will be removed, therefore a prolonged washing must be avoided, and hence all or part may be removed at will by a weak solution of carbonate of soda, ammonia or other alkali. This may be turned to account should it be thought desirable to remove the intensification locally by applying an alkaline solution with a fine brush.

Yet another method of intensification is to bleach in the following :—

A.

Copper sulphate	200 grains
Hot water	1 ounce

B.

Potassium bromide	200 grains
Hot water	1 ounce

When cool, add B to A, and immerse the plate. When bleached, wash for five minutes only, and blacken in—

Silver nitrate	44 grains
Water	1 ounce

Or for greater intensity substitute for the silver solution an ordinary developer.

REDUCTION.

We may now pass to the reverse process, that of reducing the density of a negative which has been overdeveloped. Such a plate yields prints in which the contrasts are too harsh, the more transparent portions printing fully before the light has had time to print the detail and gradation in the denser parts, or the entire negative may be so opaque that printing takes an inconveniently long time.

We have the choice of several reducers, each acting in

a special way, which gives them their respective values.

First we will consider the ammonium persulphate method, which reduces the more opaque parts first, and so, whilst generally reducing, also lessens contrasts. Immerse the thoroughly washed negative in—

Ammonium persulphate ..	10 to 20 grains
Water	1 ounce

After a little while a milkiness is imparted to the water, and the plate should be examined carefully from time to time, reduction now proceeding very rapidly. Remove the plate a little before the desired degree of reduction is reached, as the action continues after its removal, and wash in a gentle stream of water, or action may be instantly arrested by immersion in a 10 per cent. solution of sodium sulphite. Finally, wash for half an hour.

In the second place we have what is known as Farmer's Reducer, which, contrary to the persulphate, attacks the thinnest portions before the denser, and so, whilst reducing density, generally tends to increase contrast. First soak the plate in water, then prepare the following :

Hyposulphite of soda	½ ounce
Water	4 ounces

When dissolved add a few drops of 10 per cent. solution of potassium ferricyanide. The strength may be judged by the colour, which should be a good medium yellow colour. Immerse the plate, and remove when sufficient reduction has taken place. Wash thoroughly.

There are many other less used reducers of which one, an acid permanganate, must suffice. Make 20 per cent. solutions of (A) strong sulphuric acid and (B) potassium permanganate, and for use take 40 minims of A and 80 minims of B, and add 10 ounces water. Too much permanganate or too little acid will result in staining, which will be best removed by treating in sodium sulphite

60 grains, oxalic acid 12 grains, water 1 ounce, after which, however, the plate should be fixed in hyposulphite of soda bath.

SPOTTING AND RETOUCHING.

Our negative is now finished, and there only remains to see what can be done by way of making good any defects due to accident, such as tiny transparent holes, known as "pin-holes," because bearing a resemblance to pin-pricks; or there may be small circular spots of thinner or more transparent film, due to bubbles clinging to the surface for a portion of the time of development. The former would, of course, print as black specks, and hence have to be filled in, a process called "spotting." For this purpose, water-colour paint applied with a dainty touch with the point of a fine camel-hair brush will serve, or there are certain ready prepared spotting colours. Of course the little holes which have been spotted out will now print white, and these must in turn be painted out on the print; semi-transparent spots, if small, or other markings may be removed by retouching. Apply by means of the tip of the finger the least possible amount of the retouching medium to about the region where the spot or defect is, and rub with the soft part of the hand until no longer sticky, then, with a very fine-pointed moderately hard lead pencil, hardly touching the film but just grazing over it, proceed to shade in the spot until it is as dense as the surrounding part, looking through it towards the light all the time. For this purpose a retouching desk is almost essential.

VARNISHING.

The final step of varnishing the negative is one that should on no account be omitted if any value is attached to its preservation; the application of a

varnish protecting the film from scratching, staining from contact with the printing paper, and other sources of irreparable injury.

Negative varnishes of various kinds may be purchased, and most of them are to be applied to the negative when made hot.

The negative may be supported horizontally, and film side uppermost, on the extended fingers of the left hand, but, better still, with a pneumatic holder. The negative is then heated by a gas-stove or other convenient source of heat until as hot as one can bear to hold. A little negative varnish is then poured near to one corner, and by tilting the negative this little pool is induced to flow evenly over the whole surface, finishing at the corner next the one it started from, the surplus varnish being then allowed to run off back into the bottle. As soon as the excess of varnish ceases to drip, the plate is again warmed, which causes the varnish to settle evenly, and it is then placed on one side to cool in a place quite free from dust, which would adhere to the surface. It is best to let the surplus varnish drain off into another bottle to that in which the main stock is kept, so that, should it acquire any particles of dust, etc., it can be strained through cotton wool before being again used.

A few prescriptions should here be given, including backing, clearing, stain-removing and hardening.

BACKING.

This consists of spreading on the glass side or back of the negative a preparation which will absorb the superfluous light which, after penetrating the film, would in all probability be reflected back again and cause a serious blemish known as halation, and so commonly seen in photographs of interiors which include a window, or amongst trees which are projected against a bright sky.

Halation due to excess of light in certain parts is probably present to a greater or less degree in many more instances than we suspect, and only the marked improvement in sharpness and clearness which will be noticeable in photographs from "backed" plates will make us aware of it.

The plate, before being placed in the dark slide, is laid face or film side down on clean blotting or other paper, and the backing mixture spread thinly just short of the edges by ⅛th of an inch, and if this does not dry quickly enough to suit our convenience a piece of thin paper may be laid down to keep the wet mess to itself. The plate may then be placed in the dark slide.

Another method whereby messing is prevented is to use an old printing frame with the glass front, if it has one, removed. Place the plate to be backed in the frame in the usual way and close the back; the rebate of the frame protects a narrow margin all round, whilst the backing mixture is freely applied.

When developing, the backing may be wiped off with a wet sponge before development, or the plate may be put into the developer as it is, and half-way through development, when the backing has become thoroughly sodden, a rinse under the tap will wash it away. In time development, when we do not need to have the plate so transparent as to be able to be examined by transmitted light, the backing can be removed at any time so long as tiny particles of it do not settle on the film, and so prevent the developer obtaining access to it.

Backing mixtures in variety can be purchased, or the following excellent preparation may be made:—

Crystal caramel powder	1 ounce
Gum arabic	½ "
Methylated spirit	3 drachms

Mix and strain through muslin. This dries quickly. By

far the simplest course is to purchase plates ready backed. The Barnet plates are backed by the makers, and the greater convenience and avoidance of what is apt to be a messy operation is well worth the trifling extra price.

CLEARING.

A negative, either through prolonged development or due to discoloration of the fixing bath, sometimes contracts a yellowish stain which makes printing slower. This stain may be cleared off by immersion in one or other of the following :—

Alum	1 ounce
Water	20 to 25 ounces
Hydrochloric acid	50 to 100 drops

Or the following is an old favourite bath :—

Alum	1 ounce
Water	20 ounces
Iron protosulphate	2 "
Sulphuric acid	20 to 60 minims

A clearing bath containing a new substance, and one which seems to considerably brighten and clear a stained negative, is the following ; the negative must be very thoroughly washed free from hypo before it is used :—

Thio-carbamide	5 grains
Citric acid	10 "
Chrome alum	1 ounce
Water	7 "

A discoloration known as dichroic fog, which may be recognised on account of the negative having a reddish or pink colour when viewed by transmitted light, but yellowish or green when the back or glass side is looked at, should yield to immersion in—

Thio-carbamide	1 part
Citric acid	1 "
Water	10 parts

Iridescent edges to a plate, sometimes due to the plates being stale or to the composition of the developer, are best removed by rubbing firmly with a plug of cotton wool, moistened with methylated spirit, or, instead of cotton wool, the finger-tip covered with chamois leather.

Silver stains, which an unvarnished negative will sometimes contract from contact with the silver printing paper, are best disposed of by soaking the negative in the following :—

Potassium iodide	1 part
Water	20 parts
Iodine (metal) enough to impart a deep brown colour	

Even if a negative is not to be printed from immediately, its intensification or reduction, if either is required, as also clearing, spotting and varnishing, should be done before the negative is put away as finished ; it will then be always ready when required.

A. Horsley Hinton.



Orthochromatic Plates and Colour Screens.



VERYONE who has exposed a plate, and a large proportion of those who have not, are aware that the brightest colours in the scene that is being photographed are not those that are brightest in the picture, in which violet and blue appear brighter in comparison than green, yellow and red. The photographer who has studied the matter knows that the ordinary plate, no matter how rapid it may be, has but little sensitiveness to green and still less to yellow, orange and red. Although it is customary to employ ruby light in the dark-room, it is quite possible with a little care to develop ordinary plates in yellow light, or in a shade of green that to the uninitiated viewing it for the first time resembles weak daylight.

It has long been the aim of plate-makers to produce a plate that shall be equally sensitive to all colours, and although this has not yet been accomplished, there are plates now obtainable that have a very considerable sensitiveness to all the colours of the spectrum. It is true that they are still more sensitive to voilet and blue than to the other colours, but if we can contrive to lower the brilliance of the violet and the blue we shall obtain photographs in which every colour shall be represented in

monochrome with exactly the shade of brilliance it has in nature. This sensitiveness to colour is obtained by the use of dyes, of which there are a large number, each of which has a different effect from the others, so that we may buy plates that are most suitable for landscape purposes, and others that are better fitted for subjects in which there is a preponderance of red.

For landscapes, portraits, and the work in which the amateur (and for the matter of that the professional worker) is most generally interested a plate that is sensitive to violet, blue, green and yellow, leaves little to be desired and is convenient to use, as it is possible to work it in plenty of light, so long as it is of the right quality. Such a plate is the "Barnet Yellow Sensitive Orthochromatic Plate," and to that I shall chiefly restrict myself in the present instance, as it is an exceedingly rapid plate (quite equal in speed to the Barnet Extra Rapid) and capable of doing all that is required in the ordinary way. So far as development is concerned there is nothing new to be learned. In loading the dark slides, in backing the plates as a preventive against halation, and during development, a little additional care to shield them from the light is necessary, but if the dark-room lamp is of a good type no alteration is needed.

As the formula for the developer is set forth in full on the box, it is unnecessary to give it in detail here, but for the benefit of those who work the 10 per cent. system, I may say that each working ounce contains approximately 3 grains of pyro, ¾ grain of potassium metabisulphite, ¼ grain of potassium bromide, 22 grains of sodium carbonate, and 27½ grains of sodium sulphite. Other developers may, of course, be used if preferred, with the exception of hydro-ammonia and hydroquinone, which are not recommended. Beginners to whom the

general manipulation of the plate is a matter of uncertainty are referred to other sections of this book.

It may be pointed out that an orthochromatic plate will do all that any other plate of the same speed will do, and in addition will do a great many things that the others will not do, so the photographer need not hesitate to load his slides or changing-box with them. He may, if he chooses, use them in precisely the same way as he would ordinary plates, or he may employ the special contrivances to be noted later on, which will enable him to get the full advantage out of them.

We all know that white sunlight is composed of various colours, and that the spectrum is arbitrarily divided into seven tints—violet, indigo, blue, green, yellow, orange and red. We also know that every colour we see is either one of these colours, or is composed of two or more of them. As a matter of fact, every colour we see in nature reflects to our eyes, and incidentally to the lens of the camera, a proportion of white light in addition to its own particular colour. If this were not so we should be unable with an exposure of reasonable length on an ordinary plate to get detail in green, yellow, orange and red subjects. As it is, the white light which these objects reflect is sufficient to give representations of them, though somewhat imperfectly.

As already stated, the orthochromatic plate is sensitive to all the colours, though chiefly to the violet and the blue (indigo as a purely arbitrary term is generally considered in photographic matters to be included in these two), and if we were to give a sufficient exposure to allow the other colours time to impress themselves on the plate, these first would be hopelessly overexposed. If, however, we interpose somewhere in front of the plate a screen which shall reduce in brilliancy the most powerfully-acting light rays we shall give the

greens, yellows and oranges an opportunity of asserting themselves. As the plate at present under consideration is not specially sensitive to red we may leave it out of account.

The media used for screens are of various kinds: stained glass, glass coated with gelatine or collodion, and glass troughs filled with dyed solutions are all used. The last are useful in laboratory and experimental work, as the strength and also the tint of the dye may be easily altered, but in addition to being very expensive they are troublesome to carry about, and are not suitable for field and studio work. Stained glass would be the best of all if it were possible to get it of the correct colour and of the required strength. Many glass screens are sold and used, but I have found none that will correct the colours perfectly, so we are left with glass coated with some dyed material. These may be bought or they may be made by the photographer with comparatively little trouble. I have said that the different dyes used in preparing the plates give widely different degrees of colour sensitiveness, and it follows that a screen that is perfect with one maker's plate may be quite unsuitable for use with another, so when perfect correction is required and the maker of the plate does not issue a screen it is better to make screens for ourselves.

The reader is of course aware, as a matter of general knowledge, that each colour in the spectrum is complementary to some other—thus violet and yellow are complementary to each other, blue and orange the same, and green and red. A yellow screen permits very little violet to pass through it, the deeper the yellow the less the violet, and if a proportion of orange is added a portion of the blue will also be cut off. It is evident, then, that to reduce the activity of the violet and blue rays upon the plate we may employ an orange-yellow screen.

Those who possess or have access to a spectroscope will find it interesting to note the effect of holding between it and the source of light different tints of transparent colour. As, however, the effect on the plate is not the same as upon the eye we must test the screens by actual exposures, and the spectroscope need not be employed.

We must have, however, some coloured objects to act as tests, and we cannot do better than follow the instructions given by Sir William Abney. He suggests five colour patches, but with the plate we are using three of these, yellow, green and blue, will be sufficient, and the materials can be obtained from most workers in stained glass. The colours wanted are yellow (silver stained is the best) chromium green, signal green (blue shade) and cobalt blue Pieces half an inch square are large enough. They are to be arranged side by side on a bit of ground glass, separated and surrounded by black paper, which will hold them in position. The yellow stands alone. One piece of chromium green and one of signal green are superimposed for the green, and one of cobalt blue is superimposed on one of signal green for the blue. It is then necessary to bring them to equal visual brightness by covering the brightest with little pieces of celluloid film which have been developed to a grey tint. This graduating is the most difficult part of the work. The figures which accompany this article were made by a Chapman Jones Plate tester, a most useful instrument.

A different form of colour patch, also recommended by Sir William Abney, may be more easily made by the photographer. Pieces of cardboard are painted with chrome yellow, emerald green and French ultramarine blue. A little lamp-black is also wanted to bring the colours to the same visual brightness or dulness. The colours may be bought in the powder form from any

colourman. A little gum or size is mixed with the blue, and it is painted quite thickly on the card; another piece of card is painted with the green, to which sufficient black has been added to bring it to the same shade as the blue; the yellow is darkened in the sa · way. As the colours dry lighter than they are when wet, it is not easy to judge the exact shade while they are moist, and it is well to paint quite a number of pieces of card with each colour, adding a little black each time, and from these it will not be difficult to make a selection. I may say that although I have not made a set of the glass patches, I have made and used satisfactorily the painted patches. They may be arranged side by side on a piece of white or black card, and are copied in the camera in the same way that any other design is photographed, and different screens must be tried till the desired effect is obtained

Lest it should be supposed from the above, and from what is to follow, that the use of orthochromatic plates is beyond the skill of the average worker, it may be pointed out that while it is desirable that everyone should understand as much as possible about the principles of colour work, and even at some sacrifice to carry out the operations here suggested, yet better work can be done with them with the most primitive apparatus than with ordinary plates, and I have endeavoured to state the methods of making the screens in such a manner that good results may be secured in the absence of the colour patches described above.

Before proceeding to a description of the means by which the colour screens are made and tested, it will be well to examine and compare Figs. 1, 2, 3 and 4. Fig. 1 is from a negative made on a Barnet orthochromatic plate through a Chapman Jones plate-tester, in which the upright strip is grey, the lowest square on the right



Fig. 1.



Fig. 2.

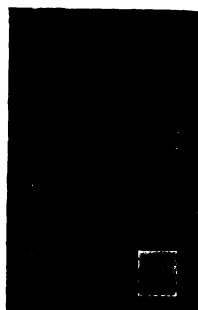


Fig. 3.

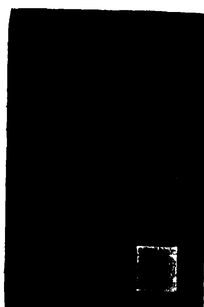


Fig. 4.

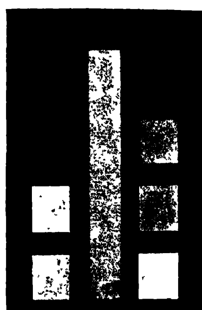


Fig. 5.

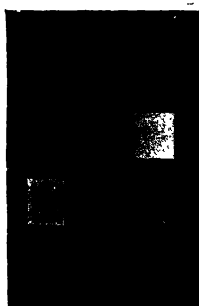


Fig. 6.



Fig. 7.



Fig. 8.

hand side is blue, the next higher is green, and that at the top is yellow. With a suitable screen all four ought to be equally dark, and it will be seen that the print is not far from being correct. The squares on the left-hand side are used for other purposes, and do not concern us. Fig. 2 is from an ordinary plate, not sensitive to colour, and it will be seen that the blue only is strongly impressed, though there are faint traces of the green. Fig. 3 is from a Barnet orthochromatic (as are all the remaining figures) exposed without a screen, and exhibits a great advantage over the ordinary plate. Fig. 4 was exposed to candle-light, and is still better, though the green is a little dark and the blue a little too light; still it shows that for some purposes very fair results may be obtained without a screen by photographing by candle-light.

We must now consider the actual making of the screens, and although collodion is sometimes used I would suggest that gelatine is easier to manipulate in all ways. The usual method is to make a solution of gelatine, to dye it to the required tint, and then to coat glass with it. When the film is dry another piece of glass is cemented with Canada balsam on top of the first, to preserve the film from injury. I have successfully made screens in this way, but the difficulties when working in a small way are great. A separate solution of gelatine must be made for each tint, it must be filtered, and, above all, the drying is a troublesome matter in the absence of a proper drying cupboard. I am told by my friend Mr. Newton, the Principal of the Bolt Court Technical School, that to ensure the absence of the curious worm-like markings sometimes seen, the conditions must be so arranged that drying shall take five days. To keep the temperature regular for such a time involves the use of apparatus which everyone cannot possess.

The method I have adopted recently is much simpler. I purchase a sheet of clear gelatine of a suitable thickness, stain it in an aqueous solution of dye to the required tint, squeegee it upon glass to dry, strip it, and then cement it as before between two sheets of glass. The gelatine can be bought from J. Bousquet, of 28, Barbican, London, E.C., in large sheets of a thickness of about one-hundredth of an inch, at sixpence each, postage extra. It is perfectly clear and fairly uniform in thickness, although it may happen that a sheet is a trifle thicker at one end than at the other. As, however, the pieces we want need not be more than two inches square or so, the variation in thickness is negligible. The same firm sells thinner sheets at threepence each, but these are useless for our purpose.

Of the many dyes I have tried I would suggest "Brilliant Yellow" and "Naphthol Yellow S.E.," both imported by the Bayer Company, and obtainable in small quantities from Penrose & Co., of 109, Farringdon Road, London, E.C., and from other chemists and dealers who stock Bayer's preparations. One ounce of each will make many hundreds of screens, and the cost is trifling. The glass is the most expensive item, as it must be clear, perfectly flat, and free from flaws, otherwise the definition of the picture will suffer. Old negative glass has been suggested, but although this is the best of its kind, yet when two thicknesses are cemented together it introduces an amount of distortion fatal to good definition. A thin so-called parallel glass can sometimes be obtained from Hetley's, of Soho Square, at a moderate price, but it is necessary that the purchaser should make a personal selection. Plate-glass ground optically flat by an optician is the most perfect, but is extremely expensive, so for all ordinary purposes I suggest the thinnest patent plate which can be obtained. It is sold by most glass merchants in

a good way of business. The size to which it is to be cut will depend upon the aperture of the lens, but three inches square will be found generally suitable, and as the cost of it is chiefly in the labour of looking it out and cutting it up, it is better to get a dozen or so of pieces at one time.

The gelatine should be cut at least an inch larger each way than the glass it is to be dried upon. Old quarter-plate glasses well cleaned with whiting and ammonia do very well, as if the dyed gelatine proves faulty in places the pieces will still be large enough for the faults to be cut away. The gelatine should be handled as little as possible, and those whose fingers are damp may with advantage wear gloves while cutting it up. A piece of the gelatine is immersed in a solution of the dye till it is thoroughly limp and has absorbed all the dye it is capable of taking up—five minutes' immersion will be long enough. It is then transferred to a dish of clean water and rinsed for a minute or two, and a piece of the clean negative glass slipped under it, when the two are lifted out and allowed to drain till all the water between the film and the glass has escaped. The corners may then be clipped off with a pair of scissors and the edges folded under the plate—this will prevent them from cockling up during drying. The glass may be then stood on the bottom of a tumbler, and the surface of the film lightly dried with fluffless blotting-paper. Care must be taken that no dust settles upon the film while it is drying ; but this is a precaution to which all photographers are accustomed.

In a moderately dry room the film will dry completely in about twenty-four hours, and then if the edges are cut round with a knife the film will fly off. No grease or talc should be applied to the glass. If it is properly cleaned with the whiting and ammonia there is no risk of the gelatine sticking. It is quite possible that every piece

will not be quite perfect, so it is desirable that two or three of each useful strength should be prepared, from which a selection may be made, and it is well to apply the tests suggested later on before cementing the film to the glass.

This cementing operation is by no means difficult. A small bottle of Canada balsam, to be obtained from dealers in microscopes or from most photographic dealers, is required. The plate-glass having been thoroughly cleaned, a little of the balsam is placed in the middle of one side of each piece, and they are placed in a warm, but not hot, oven for the balsam to soften. A perfect piece of the film rather larger than the glass is placed on top of one glass, and the other glass laid on that. By pressing on the centre the balsam can be made to spread outwards till it exudes from the edges. A couple of "bull-dog" letter-clips, or a pair of bicycle trouser-clips will help in bringing the glasses and film into close contact if the whole arrangement is again placed in the oven. It must be noted that the oven must only be moderately warm or the screen will be spoiled. When it is seen that the excess of balsam has been driven out the screen may be hung up in a warm place till the balsam at the edges is moderately hard, when the protruding gelatine is to be trimmed off, the glass cleaned with benzole, and a strip of lantern binding pasted round the edges.

The nature of the dye and the strengths of the solutions will depend upon the work to be done. When it is possible to use a screen that will correct the plate from the blue to the orange we should do so, but as such a screen requires about three or four times the normal exposure we must for some work employ one that gives only partial correction. I cannot, therefore, do better than give a number of tests made with screens of different intensities and state the nature of the solutions used, leaving it to

each worker to select those that will best suit his purpose. For stock purposes one drachm of brilliant yellow may be dissolved in one hundred drachms of water and filtered; the naphthol yellow may be made up in the same way.

In comparing the following illustrations with each other, no attention need be paid to the relative darkness of each—a slight variation in the time of development given to the negative, or of the exposures in making the prints, will affect this, and as the negatives had each to be made and tested before the next could be made it was impossible to develop them all at the same time, which would have been preferable. The point to be looked for is the extent to which equal density in the upright strip and the three right-hand squares is obtained. Some of the negatives showed a considerable action in the red, and although too feeble to appear in the prints it would still be of importance as giving a better rendering of orange.

Fig. 5 is from a negative made through a screen dyed with brilliant yellow, 1 in 10,000—that is, one ounce of the stock solution was diluted with one hundred times its bulk of water. For general subjects in which there is much contrast of colour this screen is useless, but for hand-camera work, as it only requires twice the normal exposure, it is permissible, and when open landscapes with distant hills are being photographed, or for sea-scapes, or for delicately-tinted spring flowers it will prove of service, whilst by cutting off the blue haze that spoils distant hills it will be particularly useful.

Fig. 6 was made with a screen dyed in naphthol yellow, 1 in 100. It will be noted that the yellow has been over-corrected, and if this screen was employed with landscape subjects, totally false renderings would be given. Such a screen, however, would have its uses in photographing cirrus clouds, in which it is so difficult to get sufficient

contrast. Made with a solution of 1 in 500 it would be a good screen, for taking general cloud effects. The screen used required an exposure of ten times the normal.

Fig. 7 was taken with a screen dyed in brilliant yellow, 1 in 5000. It required an exposure of four times the normal, and although the blue is still under-corrected, it is a good screen for general subjects in which there are strong contrasts of colour, and when longer exposures cannot be given. It might, for instance, be used with a lens working at a large aperture when rippling water had to be photographed, and it was desired to get fairly correct renderings of the colour values in the surrounding foliage. In portraiture also it would give good results without unduly prolonging the exposures.

Fig. 8 was taken with a screen dyed with brilliant yellow, 1 in 1000. It required an exposure of about six times the normal, and, as will be seen, approaches very nearly to what is desired, but the yellow is a shade too bright—it is in fact over-corrected. A number of experiments were made to bring all four tints equal, but at first without much success. Either the blue or the yellow predominated, or if they were level the green was too dark. At last a screen made up of one sheet of gelatine dyed in naphthol yellow 1 in 5000, and another dyed in brilliant yellow also 1 in 5000, was used with the result seen in Fig. 1. The exposure was as nearly as possible three times the normal. In making screens for use with red sensitive plates it will probably be found that full correction for the red is accompanied by over-correction for the yellow. This may be adjusted by adding a third film stained with methyl violet 1 in 5000. Such a combination is very much darker visually, and is of a deep citron colour, but photographically it cuts off very little more light, and in practice little if any additional exposure will be required.

Aniline dyes cannot always be mixed together, but these I have mentioned may be compounded in any proportions. It is, therefore, quite possible to add the violet to the brilliant yellow and the naphthol yellow in solution, and stain one piece of gelatine, with the advantage of having only one film to cement between the glasses. If instead of working in the way I have described, anyone prefers to make the screens by pouring the gelatinous solution direct on to one of the glasses, the proportions named will give similar results. Those who do not care to make the colour patches as test objects can, by following the directions given, get results that will at least be much better than those given by bits of yellow glass chosen at random.

In whatever way the screens are made it will be necessary to determine the exposures with them, and the simplest plan I can suggest without the use of special apparatus is as follows :—A bromide or platinotype print should be pinned up in good daylight, and a piece of cardboard should be placed in the bellows of the camera in such a way that one-half of the plate is protected from the image thrown by the lens. The correct exposure for such a subject is then given, and the shutter of the dark slide is closed. The cardboard shield is then shifted so as to cover over the other half of the plate, and the colour screen is placed in front of the lens. The exposure must now be given in sections by partially drawing the shutter between each. One end of the plate should receive very much less than is supposed to be the required exposure with the colour screen, and the other end very much more, while the middle sections should be given a little less, a little more, and the section exactly in the centre should have just that which is supposed to be correct. When the plate is developed it will not be difficult to decide which

exposure corresponds with that given without the screen. It is then a simple matter to decide what additional exposure is needed when the screen is used.

Those who are at all advanced in pictorial work need not be told that scientifically correct colour renderings may be quite false from a pictorial standpoint. Colour contrast and colour values are two different things. It may often happen that two objects in close proximity are visually of equal brilliance, and with the screen used in Fig. 1 would be rendered in tints of uniform grey. If, however, one was a blue and the other a yellow the contrast that was visible to the eye would be entirely lost. Even without assuming such an extreme case, it might well be that the correct screen would completely upset the pictorial balance. In such cases the choice of a screen that might not give correct colour values would yet give the truer pictorial rendering of the subject. The possession of a battery of screens and an intimate knowledge of their effects will place a power in the photographer's hands that cannot well be over-estimated.

It will, of course, be gathered that our object in making the screens is to get the colour correction with as little loss of actinic light in the camera as may be. The visual intensity of the light is of no importance so long as it does its work on the plate. In lighting the dark-room the conditions are to some extent reversed. We want the brightest light visually that we can get with the least possible action on the plate. Bearing in mind the way in which the complementary colours cut each other out, and that the Barnet plate is sensitive to yellow but not to red, it is obvious that we must for our greatest convenience use the brightest red we can get, and that will be the red just beyond the orange. Ruby glass passes very little of this red, but does pass a considerable amount of dangerous violet light, so that





PLOUGHING IN DORSET

it is necessary to supplement it with a sheet of yellow. Those who do not mind taking a little trouble can make for themselves a much better combination. Reference to Fig. 6 will show that naphthol yellow is a good base for the purpose, particularly as it is a very bright yellow visually. In conjunction with this we must have some dye that will cut out the green. A second sheet of glass coated with gelatine, dyed with rosaniline, will do this effectually, and we are left with a plenitude of bright orange that will make everything in the dark-room elearly visible. With ordinary care, plates of the nature of that we have been considering may be worked in such a light, since it will not be necessary to go closer than within a couple of feet from the lamp. With plates that are sensitive to red, and for workers who are not speedy in manipulation, it may be advisable to add a little methyl blue to the yellow. This will cut out the orange and still give a good working light.

The lamp should be glazed with a piece of ground glass, and the compound screen fitted half an inch or so in front of it to lessen the risk of the gelatine being scorched.

Since writing the above I have made a number of screens dyed with a combination of naphthol yellow and naphthol green with excellent results. Various proportions have been used, but a good working formula is two grains of naphthol green and one grain of naphthol yellow in six ounces of water. The depth of tint to which the gelatine is to be dyed will depend largely upon the class of work for which the screens are being made For landscape work in which there are strong contrasts of colour, and in which even the faintest traces of clouds present in the sky are to be preserved in printing strength, screens requiring six times the normal exposure will be found useful. In making such screens the gelatine may be immersed in a solution of

dye of the concentration given, and allowed to take up all it will absorb. It should then be rinsed several times in cold water till the tint is sufficiently reduced. Better and more regular results are obtained in this way than by dyeing to the strength required and then rinsing briefly.

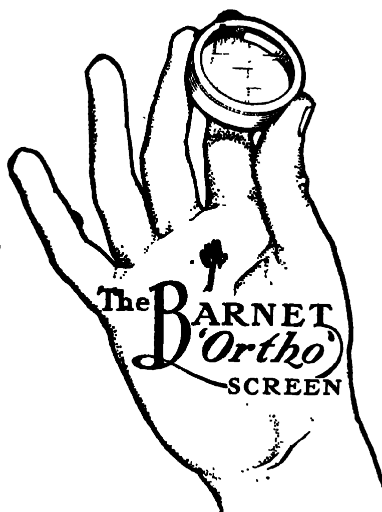
A six times screen necessitates inconveniently long exposures for many subjects, and is unsuitable for most flower studies, so it is as well to make a series ranging from one and a half times up to six. The cost and trouble of making such a series is little more whilst one is engaged in the matter than in making one, and a good plan is to dye, say, three pieces as described, then to dilute the solution to half strength, to dye three more, and so on. The pieces of gelatine may be washed out to different degrees of tint, and all may be mounted, or a selection only may be so treated and the remainder stored away till wanted.

For the benefit of those who wish to make one or two screens only, it may be pointed out that a piece of roll film fixed, washed, dried and dyed is practically as good, and is somewhat easier to manipulate, than plain sheet gelatine. It must, of course, be cemented between two pieces of clear glass.

Naphthol green stops but little of the red, and with the screen described correct colour values are given well into the orange.

In conclusion, it may be said that those who have once mastered the orthochromatic plate will be loth to revert to the ordinary type for subjects in which colour plays a conspicuous part.

John McIntosh.



BARNET ORTHO. SCREEN.

4 TIMES.

The BARNET ORTHO. SCREEN is a scientifically constructed instrument, composed of a dyed film, mounted between two optically-worked glasses, set in a highly finished brass mount, with spring adapter, contained in circular box, which forms a lens cap. It is accurately adjusted, both as regards the dye and depth, to give the most perfect results in general landscape work with Barnet Ortho. Plates, and for taking clouds, copying pictures, and for flowers of mixed colours.

PRICES.

Size		Price
$1\frac{5}{16}$ in. diameter	- -	3/-
$1\frac{11}{16}$ in. ,,	- -	3/6
2 in. ,,	- -	6/-
$2\frac{1}{8}$ in. ,,	- -	6/-
$2\frac{1}{4}$ in. ,,	- -	6/-

Larger or smaller sizes to order at special prices. Lighter or deeper screens can also be specially made to order. Prices on application.

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Film Photography.



NQUESTIONABLY the enormous popularity that photography has attained during the last few years is largely due to the introduction of films. Both flat films and the newer daylight loading roll films have contributed to this popularity, for the introduction of celluloid as a base for the sensitive gelatine emulsion has enabled the traveller and the holiday-maker to add a camera and an adequate supply of material to his outfit, without, as hitherto, burdening himself with a dead weight of glass plates, which are at once an incubus and an annoyance. The ever-present dread of breakage through careless handling, the constant necessity of obtaining dark-room accommodation, an accompaniment to the holiday which the roll film has almost abolished, all tended to increase the troubles of the amateur photographer, who has ere now discovered that it is just as possible to get perfectly good negatives on films as ever it was on glass plates and with none of the attendant risks.

The danger of halation has also been practically banished by the introduction of films. With a glass plate, unless it is properly backed with a soluble caramel backing or paint, there is an amount of halation which renders it difficult, or impossible, to secure good effects against the light, or where there are violently contrasting lights and shadows, such as the outline of masts against a sunset sky or the delicate tracery of twigs and leaves in a landscape scene. For interiors the unbacked

plate is absolutely useless if windows are to be included, and there are many other drawbacks which only the unfortunate user of unbacked plates discovers. The celluloid basis of a film is so much thinner than even the thinnest glass plates, that this trouble of reflected light is practically non-existent. No backing is required except in the most extreme cases, and seldom, if ever, is there more than the slightest trace of halation even with very troublesome subjects. The saving of weight and storage space, either before or after development, are advantages that do not require to be urged, as they are patent to the most casual observer; but it is not until one has accumulated a large stock of negatives both on glass plates and celluloid films that the really marvellous saving of space is quite realised.

Films, then, have the advantage of being lighter, less liable to breakage, take up less storage-room, and do not produce halation. They are a little dearer than glass plates, but the other advantages perhaps outweigh that. With roll films the price rises to rather more than double that of a backed plate, but the difficulties of manufacture must be taken into account, and the incalculable advantage of being able to dispense with that holiday bugbear, the dark-room, both when loading and unloading the camera, is surely enough to justify the extra expense.

As some of the readers of this article may still be unwilling to concede the advantages already enumerated, there are still one or two more points in favour of the celluloid film. Being light and flexible, they may be sent by post in an ordinary envelope with little or no packing; and this should appeal to any amateur who is in the habit of sending his negatives to some trade retoucher or to have enlargements or prints made. Films may be printed from both sides, which does away with the need for double transfer in carbon work.

Some of those workers who are so wedded to the use of glass plates that they will not admit that celluloid films can ever approach them say that one of their principal objections to films is that they do not keep well. Perhaps before development in hot climates they do not, but after development they will keep indefinitely, providing, of course, that they have been properly fixed and washed The deterioration before development is only found in exceptional cases, and even plates have been known to fail in the same way.

Flat films are cut sheets of celluloid coated with sensitive emulsion and made in the same sizes as glass plates. They are put into an ordinary carrier, dark slide .or changing-box, just in the same way as a plate, and in the subsequent operations of development, fixation, and drying there is no special treatment required. Certain developers must be avoided, and rapid drying with alcohol would prove fatal owing to the fact that the celluloid would probably dissolve away. Both pyro-ammonia developer and acetone are liable to play havoc with films. The three A's—acetone, ammonia and alcohol—therefore, had better be avoided, while yet another A, the acid fixing bath, is inadvisable.

The rest of this chapter will be devoted to the use and treatment of the deservedly popular roll film, and will endeavour to show how, with intelligent treatment, the roll film can produce not only perfect negatives, but can be manipulated with both celerity and certainty.

Photographers who are accustomed to handling plates and flat films frequently complain that they have great difficulty in making the short sections of rollable films keep under the developing solution, and many and curious are the devices that have been adopted to secure this end Some of them, although undoubtedly ingenious, are more trouble than they are worth, as the

reader will no doubt discover if he attempts to use them. One writer recommended the use of a wood-bottomed dish, and suggested pinning down the four corners before pouring on the developer. Another man states that he keeps his film sections flat by placing coins on the edges of the film, but he acknowledged that the rocking of the dish was apt to dislodge his makeshift weights, and the remedy was almost more trouble than the original complaint. Personally I never had any serious trouble in keeping the films quite flat when developing them in short sections, which is due to the fact that I always gave them a long preliminary soaking before attempting to start development.

We will suppose that a spool of a dozen has to be developed, and the nature of the exposures, or the inclination of the exposer, demands that they shall each be treated separately. The seal is broken, and the black paper is gradually unwound until the white sensitive material can just be seen by the light of the red lamp. Turn the spool over in the hand, and then with a pair of scissors make a good clean cut along the white line that marks the division between exposures eleven and twelve. In unwinding, the film must be held firmly in contact with the black paper, care being taken not to let it slip over the paper as it unwinds. Section number twelve will be rather longer than any of the subsequent sections, and this should be noted so as to avoid cutting into the exposed surface in number eleven. Experts may think this is a needless piece of advice, but one does now and then hear of films damaged by being cut off badly, and it should therefore be borne in mind. Each of the sections as it is cut off should be dropped into a deep ewer or bowl of water and left to soak until required, and the winding spool, with such black paper as remains, can be thrown away. By following

these instructions it will be found that the cut-off pieces of black paper roll up *above* the sensitive film and can be secured with the first finger and the thumb of the left hand, so that they do not drop into the water as well. Now cover the ewer up carefully and get the developer ready. A deep dish should always be used, and plenty of developer. It is no good attempting to use two or three ounces for a quarter-plate film in a 5×4 dish, because you are simply courting disaster. With eight ounces you have a far greater chance of success, and then if your film does not keep quite flat there is room for it to arch up a little and still not get above the surface. We will now suppose everything is ready, and you have dipped into the ewer for a film.

The water has probably made the section quite limp, and it should be immersed quickly by sliding it into the solution face upwards. This allows the developer to flow across it evenly, and as soon as this has happened you should turn the film over so that the sensitive side is next to the bottom of the dish. The film will then probably arch slightly in the middle, but after a few seconds it will flatten out, and there is no need to touch it again for a few minutes. The progress of development can be watched from the back of the film, and the amount of density that it has attained can be judged to a nicety.

Another convenient method of developing the separate exposures which may be preferred is to fill a flat-bottomed measure, or, better still, a thin tumbler, with developer, and put the sections into that. The slight curling makes the film go conveniently into the glass, and the progress of development can be watched through the sides of the tumbler. Air bubbles, if they form on the gelatine surface, can be shaken off instantly by pressing the palm of the hand over the top of the glass, and shaking the glass and contents once or twice with the

other hand, or the film may be lifted up and dropped back again two or three times.

There are one or two useful commercial appliances for keeping film sections flat, and in this connection I might mention the " Primus " film-holder, which consists of two small clips, which grip the edge of the film, and are themselves held in place by a spring handle. This little piece of apparatus entirely removes the necessity of dabbling one's fingers in the developing solution, and in the case of pyro this is an advantage not to be overlooked.

This method of tentative or personal development has many adherents, and I have therefore devoted more space to it than I perhaps should have done otherwise. Roll film users have, however, discovered that there are other and easier ways of obtaining negatives, and the majority of them have adopted the strip method. This, as the name applies, means developing the whole spool at once. The black paper is all unwound, and the sensitive film is rolled up in the hand before development. A pair of strong clips, sold by most photographic dealers, should be first attached to the two ends of the strip. The preliminary washing is carried out by drawing the film through a bowl of clean water, and development is conducted in much the same fashion. Big dishes are necessary and plenty of developer ; but for expedition there is nothing like it, although, in the case of a very varied series of exposures, one may now and then find one negative that requires longer development than the others. If such a case occurs, that negative must be cut out and allowed to remain in the developing bath after the others are done, but the occurrence is rarer than one might be led to suppose.

As far as my own practice is concerned, I have almost entirely adopted Mr. Watkins' method of development by factor, and find it by far the most satisfactory way

of obtaining good and regular results. In the chapter of this book devoted to Negative-making the factorial method is fully described, so that I scarcely need occupy space with it here; still, there are just a few points to be remembered. A slow developer, with a high multiplying factor, is not particularly suitable for the ordinary strip development, as the continual and necessary movement of the arms is liable to tire one before development is really complete. Rodinal, which, in my opinion, is the simplest and best commercial developing agent obtainable, had practically to be discarded on this account. Negatives developed with rodinal lose some of their density in the fixing bath, and the time of development is rather long to compensate for this. I therefore used for some time the following pyro-soda formula, which gives negatives of a particularly useful character. As will be seen, however, it differs but little from the Barnet pyro-soda developer given in the chapter on Negative-making.

No. 1.

Sulphite of soda	6 ounces
Water	32 ounces
Pyrogallic acid	1 ounce

No. 2.

Carbonate of soda	3 ounces
Carbonate of potash	1 ounce
Water	32 ounces

For normal exposures use equal parts of No. 1 and No. 2, together with sufficient water to double the quantity used of the two solutions. As this is somewhat apt to oxidize rapidly, a little metabisulphite of potash should be added. The factor for this formula is ten, and development is usually complete in six or seven minutes.

As, however, I have a great liking for the delicate negatives that rodinal alone seems capable of yielding, and at the same time was sufficiently enamoured of the "always ready" character of that estimable preparation, I devised a means of overcoming the tiring way of "sawing" the film up and down during the twelve

long minutes that rodinal demands: and this is what I did. A screw eye was fixed into the wooden ceiling of my dark-room, and a thin cord with a small weight attached was passed through it. To the other end of the cord a strong clip was fastened, and this clip received one end of the film. I then got one of the special film developing dishes (of which there are several patterns obtainable) mounted on a wooden base with an adjustable arm for passing the film under. This arm carries a vulcanite roller, and by means of this the film is kept beneath the surface of the solution; the weight attached to the cord keeps everything taut, and then all one has to do is to pull the clip attached to the other end to and fro, and the whole film is developed with an ease and convenience that must be tried to be believed. A similar device was recently described and illustrated in the "Photogram."

The use of daylight developing machines has to a certain extent quite removed any necessity for the dillettante even to possess a dark-room or a red lamp; but it is quite a question whether the amateur who loves his hobby for its own sake and revels in all the various and necessary operations will ever take kindly to mechanical methods. Even with the proper application of the Watkins system (multiplying the actual time of first appearance in seconds by the factor of the developer), there is a popular desire to *watch* the image built up, although relying on the result of the calculation to determine how long the film shall remain in the developer. Perhaps it requires too much courage, or shall we say faith, in the system, for some photographers to desert their beloved negatives in the making; but if only they would have this faith and either screen their lamp or cover the dish and let no light, even the "safe" rays that filter through the red glass, come to their films at all, the results would be much more satisfactory.

The best of lamps sometimes produce fog, that worst of enemies that the photographer has to contend with. Then, too, there frequently comes a desire to take the film out too soon because it appears to be getting too dense. If your factor is right and you made no mistake about the time of "first appearance," there is no possible chance of going wrong, and it is better to let things take their course and not meddle.

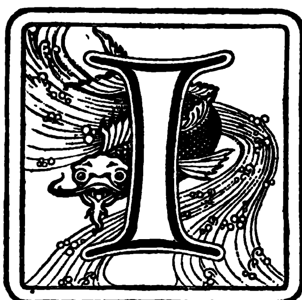
A few hints about washing and drying the film will probably be of use. If the exposures are cut off separately, one good method is to pin each film by one corner to a small cork and let it float about in a large bath fairly full of water. The film naturally hangs downwards, and what hypo there is gradually falls down to the bottom corner and then drops to the bottom of the bath. With strips of film the bath will also came in useful in this way. Get a lath, say, about four or five feet long; pin one end of your strip of film on to one end of the lath and fix the other end in a similar manner. If your lath is thick enough you can put the pins actually on the end, and then the heads will act as buffers to keep the floating lath from scraping against the sides of the bath; but, if not, turn about half an inch of the film over the end and pin it down on the upper surface. The strip of film will hang down in a big loop from the floating lath (if the loop is too big, pin it up in the middle and make two smaller ones), and the hypo will drain out in a most exemplary fashion. Of course, in adopting this idea you must remember to give all your films a good preliminary swill after they leave the fixing solution and again after the all-night soak. This is much simpler and gives less trouble than any other method, and the results are absolutely certain. Those who have not a good supply of water at their disposal might try this alternative. Take half a dozen tumblers

and fill them all with water. The films should be cut into sections, and as they leave the fixing bath they are passed through the half-dozen tumblers in succession. Each film should be drained before being changed, blotted with fluffless blotting-paper, and five minutes' soak in each glass should be allowed. By doing this the greater part of the hypo is removed, and a final soak for an hour in a tumbler of clean water will remove the last traces of hypo that are likely to do any harm, so that a dozen films are efficiently washed in little more than a gallon of water. One of the hypo eliminators that are now advertised so freely might also be employed to advantage, but it is best to use an eliminator in conjunction with washing rather than instead of it.

For drying I prefer to pin the four corners down on to short lengths of board, and then set these boards up in a good dry place well out of the way. Blotting-paper can be employed to take off any excess of moisture, a d by leaning the boards against the wall with the films face downwards practically no dust can settle on them

Perhaps some of my explanations may have been a little diffuse, for it is difficult now and then to describe exactly some of these time-and-trouble-saving devices that practice has taught one. The roll film has many friends and many enemies, but I venture to say that the objectors only object from a want of knowledge, or, knowing too little, condemn too much. To the traveller, to the photographer who is enthusiastic enough to have a camera in his pocket on every available opportunity, the roll films have made themselves absolutely indispensable. Many a treasured negative might never have been obtained had it not been for the invaluable daylight loading rollable film, and the equally invaluable folding pocket camera that one seems invariably to associate with it. *Percy G. R. Wright.*

Lantern Slide Making.



THINK we may take it for granted that most photographers know what a lantern slide is, even if he has never made one or seen one made.

It is a transparent print on glass, and one which is intended to be viewed by being projected upon a white screen by means of an optical or what was formerly called a "magic" lantern. This transparent print is now always made, for convenience of handling, storing, and optical purposes, on one size of glass, which in England is 3¼ inches square (3¼×3¼).

Lantern slides of to-day are made generally upon commercial lantern plates, which are to be bought from any photographic dealer. There are many ways and means of making lantern slides but when I say that 99 out of every 100 slides made and by the best workers, are on plates bought ready coated, such as BARNET LANTERN PLATES at 1s. per dozen, it will be easily seen that no other method of the ordinary worker is worthy of our consideration here. Now let me say at once that any photographer who can make a decent negative can also make decent lantern slides. The making of technically good slides is purely one of practice, in which the worker will find out many unwritten laws as his experiments proceed.

Yet, if one wishes to rise above the level of making

ordinary slides, there is just as big a field before him as in paper printing. I claim that the slide-maker, if he wishes and has the artistic knowledge and good taste, commands the same power of expression, the same power of control in printing and colour, as does the pictorial man on paper, and if each is shown with knowledge the perfect slide will stand as an artistic production just as well as a paper print—an artistic production, not art.

Now to be perfectly practical in the matter of slide making let me advise all workers to take interest in details of their work, and observe cleanliness in all branches of their slide making.

We will take it for granted that negatives for slide making are already at hand, say ¼-plate or less (the larger size we will deal with later); all the work is conducted in the ordinary dark-room, where a good supply of water can be at command. The dark-room can, when slide making, be illuminated with a greater amount of safe light than when negative developing.

Now let us see that we have the following articles at hand ready for use :—

1. A quarter-plate printing frame, or better still one of the many excellent lantern slide frames, made especially for the purpose.
2. Dish, for development.
3. Dish of hypo, for fixing the slides just as in fixing negatives after development.
4. Bottles of developer as described under "Development."
5. Box of lantern plates as bought from the dealer at about 1s. per box of 12.
6. A by-pass gas-burner, fixed to gas (if used).

It will be thus seen that one has not a new lot of apparatus to purchase for slide-making.

First of all I would recommend all workers to follow these three rúles :—

1. Sort out all negatives into three or four classes according to their densities, and make up each class into slides before touching the next. In this way one will soon find the exposure of each batch, and risk of failure will be much reduced.
2. Make a series of trial exposures on one negative from each class, the development of it will soon show the correct exposure.
3. Make a standard distance from the lights for all exposures. Thin negatives, however, may be exposed further away, and dense ones nearer with advantage.

Now we take our printing-frame and place in it the negative, open the box of lantern plates and place one upon that portion of the negative you want to appear on the lantern slide ; place the negative film and lantern plate film face to face just as in making a P.O.P. print ; now place upon the back of these a piece of dark cloth or red blotting-paper, and fasten down the back, and we are ready for the exposure, upon which much depends.

If gas be used in the dark-room a by-pass burner will be found of advantage, because not requiring to be re-lit after each exposure.

Using the same light, whatever it may be, each time, and holding the frame at the same distance, will make the process much more certain.

There is one point which the beginner should carefully note in holding the frame to the light, and that is, the distance. The theory of illumination may be briefly illustrated as follows :—

The intensity of illumination on a given surface is inversely as the square of its distance from the source of light. This means, that if at a distance of one foot from

a gas-jet or candle-light an exposure of 30 seconds is correct, and should the distance be increased to two feet, the corresponding exposure will be two minutes, and so on as this diagram shows.

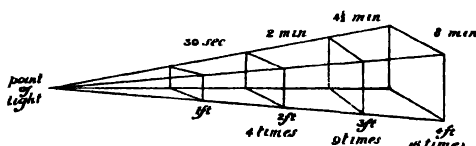


Fig. 1.

But there is this difference in practice, the light has less power to penetrate the dense portions of a negative as the distance increases, and as previously stated dense negatives are best exposed nearer and weak ones further away from the light.

Let us expose our plate that is waiting in the printing frame, say, thirty seconds at 2 ft. from a good Bray No. 6 burner and see how far we have been successful.

If any part of the negative is unequally dense and requires more exposure than the rest to bring it fully out, the ordinary portion of the negative should be shaded with a piece of brown paper kept moving, whilst the dense portion receives more exposure.

If the negatives are upon films a piece of clean glass should be placed at the bottom of the printing frame so that it will be held quite flat.

DEVELOPMENT.

Our plate is now ready for development, and for this purpose we make up the following good all-round developer :—

No. 1.

Hydroquinone	160 grains
Sulphite of soda	2 ounces
Bromide of potassiu	30 grains
Water to make up..	20 ounces

To make up this No. 1 proceed as follows :—Dissolve 2 ounces of sulphite of soda in 10 or 12 ounces of water and then add bromide of potassium and the hydroquinone and make up to 20 o . with water.

No. 2.

Sodium hydrate	160 grains
Water to make up..	20 ounces

It is always advisable to shake up both bottles before using them.

Hydroquinone will almost refuse to act in cases where it is used at a very low temperature, and many failures to obtain satisfactory slides can be traced to using developers at too cold a temperature ; for use take ½ ounce No. 1 and ½ ounce No. 2 and 1 ounce of water and mix well.

Place the lantern plate in the dish and flow over it the developer in one even sweep, taking care that no air-bubbles appear. Keep the developer moving, and if exposure has been correct the image should appear in thirty seconds to one minute, and development will be completed in about three or four minutes. It should develop up clear and strong, without hard, harsh contrast, and with soft gradations from high-lights to shadows. If slower in coming up it indicates under-exposure, and the result will be dense shadows and clear glass high-lights. If it comes up too quickly the result will be flat, and lacking in contrast or gradation.

The making of technically good slides is purely one of practice, just as in negative making. When to stop development is always the point where the beginner fails, and it is a point in which but little help can be given him.

It is, however, advisable, when the image comes up nicely and gradually, with all its parts in order, to just over-develop it. That is to say, when the picture has

reached its best to the eye let it go a little further and appear to be 15 per cent. overdone. This will be reduced away in the fixing, and the result should be correct.

Take the plate out of the developer and wash well under a flow of clean water and fix, as in negative making, for ten or fifteen minutes.

FIXING BATH.

The fixing bath, which must always be used quite clean, is made as follows :—

Hyposulphite of soda	5 ounces
Water	20 „

When the slide comes from this fixing bath it must be well washed just as a negative, and dried away from all possible chance of dust.

The slide is best examined when dry, as we can then better judge the points. The colour should be a warm black, which is very pleasing for a great variety of subjects. The colour, to a great extent, is regulated by the quality of the negative, the exposure given to it, and the developer used. A good average negative exposed fully and developed with a normal developer will yield a nice warm colour, yet the same negative exposed just enough will result in a colder colour. Thus it will be seen it is possible to obtain a long range of colours upon the same make of plate and developer by varying the exposure.

Good negatives give the most satisfactory results in slide making, as in all other photographic processes.

A very poor, thin negative does not give the same scope, and whilst a good slide can be made fom a poor negative by skilful treatment, it is only a makeshift.

A hard, harsh negative should be given a liberal exposure or be even over-exposed to aid in building up gradations that are not easily printed from such a negative.

The worker is strongly advised to keep to one developer. It will be really surprising what can be got out of it when one comes to know it well, and to do this it must be in constant use.

Two other formulæ of well-tried developers are here given :—

METOL DEVELOPER.

No. 1.

Metol	100 grains
Sulphite of soda	2 ounces
Water to make up..	20 „

No. 2.

Potassium carbonate	300 grains
Ammonium bromide	60 „
Potassium bromide	120 „
Water to make up..	20 ounces

For use, take equal parts of each.

Length of time taken in developing, two to three minutes.

PYRO DEVELOPER FOR WARM TONES.

No. 1.

Pyro	¼ ounce
Sulphite of soda	1 „
Water to make	20 „

No. 2.

Ammonia bromide	150 grains
Ammonia ·800	200 minims
Water to make	20 ounces

Time to develop, about five minutes. This gives a good image on the screen.

Now the process of development in the making of lantern slides can only be learned by experience, but it is surprising how easy it is with a little practice to learn to make slides of good uniform quality

There is one important point to observe in developing slides, and that is as regards the density. We will explain. If the slides are to be shown in a small room and upon a small sheet by lime-light, the dense slides

will appear best; yet if the same slide is shown in a large public hall upon a sheet double the size and with the same lantern, the slide will appear hopelessly black. It is best to make slides of fair average density to suit public-hall work, and if they at any time have to be used in a smaller room and they appear too thin, less light can be used upon them through the lantern. Thus it often happens when slides are judged at exhibition upon small sheets the dense ones look better and so gain the awards, yet the slides look hopelessly at fault when they are shown in public. These slides should be judged upon a full size sheet to do them justice.

A good lantern slide may be said to be one in which the whole of the image is of the most translucent character, in which the colour of the deposit caused by the developer is pleasing, and in which the tone values and gradations are proportioned in such a manner as to be suitable to the character of the light that comes from the lantern.

SLIDES BY REDUCTION.

Thus far we have been dealing with slides made by contact—the lantern plate in contact with a negative of the same size or smaller—but this limits us to making slides from a negative or a portion of the negative 3¼ in. square. But the negative or the image to be included may exceed this, and we must then adapt some method of reducing the subject to the size we require. This is done by copying, the negative being set up and photographed just as a view or portrait, the subject being made 3¼×3¼ in. on the ground glass, and the plate used in the dark slide being a lantern plate. Thus it will be seen that it is possible to copy any size of negative, however large, and make a slide 3¼ in. square to fit the lantern just as easily as one from a small negative.



LOGAN BERRIES
By CLARENCE ELLIOTT — Taken on a Barnet Ortho Plate

Some workers assert that slides made by contact are never so good as those made by reduction ; and if care is not used in the contact method much may be lost in sharpness, but perhaps a good deal of what is put down to superiority is not so much technical merit as a certain artistic quality. I have failed after repeated tests to discover any technical difference between a slide made by contact and one made by reduction, the same subject and *exactly the same portions* of the negative being used in each case.

There are cheap pieces of apparatus for daylight use upon the market for reducing negatives to slides which will save the worker endless trouble ; they are most efficient and speedy in use, and are to be recommended to any who can afford the few shillings they cost.

For reducing by artificial light more expensive apparatus is needed, on account of the condenser being required. A simple plan is to have two cameras—a large one to hold the large negative at one end, and a small one to hold the lantern plate. Place the two on a long board, remove the lens from the larger camera, and through the hole thus left point the lens of the small camera. Now place the big negative to be reduced in the dark slide, and place it in position in the big camera, and draw both shutters. Adjust the whole board to the light and photograph the big negative with the small camera, using a lantern plate for the purpose.

Development is the same as in the case of contact slides, which has already been described.

CLOUDS IN LANTERN SLIDES

A lantern slide with a clear white sky is an unfinished production, and it is so simple a matter to put in clouds that there is no reason why such slides should be shown at all. The beginner must not think it is a difficult

matter; and it is hoped that the following brief description will reveal its simplicity.

First make a slide in the usual way of a subject, which we will call the foreground or landscape slide. There may be more or less sky showing on it, but this must be quite clear. We take a sky negative, the lighting of the clouds being in accordance with the light in the foreground slide. Mark off from the sky negative with brown paper that portion of the sky negative on which the landscape would encroach, and proceed to make an exposure on a separate lantern plate for the sky only.

These two lantern plates when dry, and placed film to film, should fit together and form one whole slide. It is not at all a difficult matter, and a little practice will quickly turn even a beginner into quite an expert with the process.

REDUCING AND INTENSIFYING.

Lucky is the man who can always make the slide he wants. Oftentimes a slide comes out of the fixing bath a little too dense or just a trifle thin, or maybe there is just one corner too dense, which spoils the whole. In such cases a reducing bath must be resorted to.

First we will take in hand slides that are heavy, dense, or over-developed either in whole or part.

The Howard-Farmer reducer is a standard one for this purpose—it is well known and is generally satisfactory:

No. 1.

Hyposulphite of soda	**1 ounce**
Water	**10 ounces**

No. 2.

Saturated solution of ferricyanide of potassium.

These should be mixed only for immediate use.

Take 2 ounces of No. 1 and 10 drops of No. 2.

Soak the slide to be reduced and place it in the solution, watch it carefully and take it out before the full

reduction you require is reached, and wash well at once. If only partial reduction is required use a soft camel-hair brush, and apply the solution to the parts required. The solution may be used stronger or weaker as the density of the slide requires.

This reducer acts more quickly upon the high-lights and half-tones than upon the dense portions, and it must be carefully watched on this account. If the dense portions require acting upon most, as is generally the case, the Persulphate of Ammonia Reducer should be used, as it attacks the dense portions first and other parts later. For particulars of its composition and use see p. 36.

Slides which, from over-exposure or other causes, are flat and thin may be made more useful by simple Intensification. First they must be well washed quite free from hypo.

Take the slide and place it in a clean dish, and flow over it of the following sufficient to cover the plate well :

Mercury perchloride	2 drachms
Ammonium chloride	1 drachm
Water to make	10 ounces

This can be used repeatedly.

When the slide has assumed a white appearance take it out and wash it well for five minutes ; now take another dish and place the slide in it, and flood over it a solution of liq. ammonia ·880 1 part in 10 parts water. This will at once darken the slide and make it much denser. Other methods of Intensification identical with those given in negative making may be found in the chapter under that heading.

There are many points in the practice of lantern slide making that have only been briefly touched upon on account of space, but the slide-maker will have had given him sufficient to indicate a course of work and

study; every earnest slide-maker finds out ways and means of his own as his practice extends, and it is such matters arising out of experience that go to make up our successes.

MOUNTING AND BINDING.

When the exposed, developed, and fixed lantern plate is finished we shall require to mount it so as to protect it from injury, and a certain exactness and neatness in this connection is essential. The first things to obtain are what are known as cover glasses; these must be the same size as our slide, 3¼ in. square, and should be as thin as possible. For this purpose the beginner will find his spoiled lantern plates with the old emulsion cleaned off just the thing. Wash them well and polish, and only use those that are free from scratches and bubbles.

Next, some paper masks will be required such as are sold for the purpose, known as lantern-slide masks. These are square pieces of opaque paper 3¼ in. square, and with cut-out openings of various shapes and sizes. Oblong shapes will be found the most useful. Ovals and circles are to be recommended least of all.

Binding strips are also required—these are narrow strips of black gummed paper, which are used to bind the slide, mask and cover glass together.

Take a piece of clean white paper, and lay it on the table before you. Examine the lantern slide and see it is perfectly dry. Gelatine such as the lantern plate is coated with absorbs moisture, and undergoes decomposition much more readily when damp.

Hence it is a good plan to warm the slide well before the fire before binding it up, and also see that the mask is bone-dry. This done, place the slide, face or film side up, upon the sheet of paper, and upon it lay the mask of paper that suits it best; in this the same taste

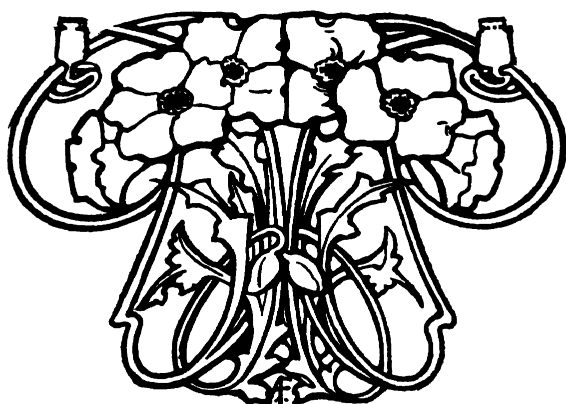
and judgment should be used as in trimming a paper print. See that all dust has been brushed off the slide and place upon it the cover glass (or, if a cloud is to be introduced, the sky slide) having the film of the slide and the paper mask between the two. All that requires doing is now to bind round the four sides of the two glasses with the binding strips, seeing that they are well secured all round. This will protect the whole slide and keep it from scratches and damage.

It is now important that the slide shall be marked in such a way that there shall be no doubt as to how it is to be put in the lantern, for it must be remembered that the lanternist works mainly in the dark.

A recognised standard of marking has become established to ensure correct working, and this is quite simple. Hold the slide in such a position that you can see the subject just as in nature, then place on the top corners of the slide two round spots of white paper. With a slide so marked, any lanternist who may happen to handle the slide will know that for the picture to appear on the screen in the right way he will have to place the slide in the lantern with the spots downward and towards the light.

Before being shown, slides should be carefully cleaned of all gum and dirt, and finally polished with a soft rag.

S. L. Coulthurst.



Photographic Lenses.



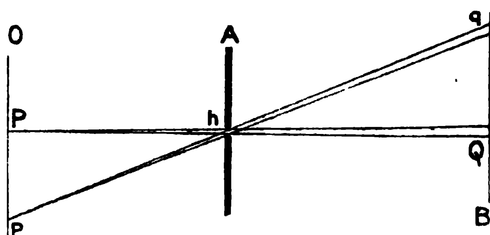
IF an object is to be photographed it must be luminous —that is to say, it must either be a source of light or must reflect light emanating from some other source. The surface of such an object may then be considered to consist of an infinite number of luminous points, each emitting light in straight lines in all possible directions.

USE OF PIN-HOLE.

If in front of a luminous object, O in Fig. I, we place a screen A, perforated at *h* with a small pin-hole, then a certain portion of the light emitted from each luminous point of the object will find its way through the pin-hole and produce a spot of light upon a second screen B. Thus a point P will be represented by a spot at Q, and another object point *p* by a spot at *q*, so that from Q to *q* we shall have an image of the object from P to *p*. But these spots will be appreciably large, however small the pin-hole may be, hence, two very slightly separated object points will be represented by two overlapping spots between which it will be impossible to distinguish. Therefore very fine detail cannot be sharply defined with a pin-hole, though finer definition is possible than is generally supposed by those who have had no experience of pin-hole work.

The pin-hole has also the defect of transmitting such a small quantity of light that very long exposure is necessary to produce any developable effect on a sensitive

plate, but it has the virtue of always drawing form correctly and in true perspective. Fig. 1 shows that all the little beams of light that reach the image screen must pass through the pin-hole and intersect one



another at the point *h*, and, this being the case, the mage is a true geometrical representation of the objects whether the latter is a plane or a solid. If the object be solid the image is in "plane perspective," while *h* is

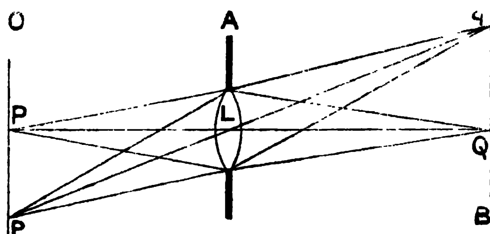


FIG. 2.

called its "station point," and perspective is always true if a true station point exists

ACTION OF THE LENS.

With a good lens both defects of the pin-hole are remedied. It transmits a very much larger amount of light, and, if properly "corrected," it will produce a finely defined and accurately drawn image of the most intricate detail. Fig. 2 is similar to Fig. 1, but shows

a lens, L, in place of the pin-hole. It is, however, only an emblematic lens, and not illustrative of the form of a photographic lens, which is a much more complex arrangement. It is easily seen that the lens must transmit more light than the pin-hole, being of larger area, but it is also obvious that to act perfectly it must concentrate *all* the light that it collects from any one object point on to the corresponding image point, or "focus," and at the same time must correctly locate all the numerous foci that make up the complete image. These conditions are essential to the formation of a well defined and correctly drawn image, but they are not fulfilled unless the lens is especially constructed, or "corrected," for the purpose.

The light received by the lens from any object point is of necessity always divergent, as shown in the diagram, and forms a divergent "pencil" of light, though when the object is at a very great distance the divergency is so small that the pencil may practically be called parallel. The photographic lens, whether a single lens or a combination of lenses, must have the power of converting such a divergent or parallel pencil into a convergent one, otherwise it can form no real focus of the object point; therefore the lens must be of the class known as convergent or "positive" lenses. A combination of lenses that is positive as a whole may, however, include one or more "negative" or divergent lenses, which, used alone. cause parallel pencils to diverge and render divergent pencils still more divergent. Single lenses of the two classes can be distinguished apart from their effects, a positive lens always being thicker in the centre than at the edges, and having at least one convex surface, while a negative lens is thinnest in the centre, and always has at least one concave urface.

CORRECTION OF LENSES.

A photographic objective is almost invariably a combination of a number of positive and negative lenses of various forms and varieties of glass, so arranged that the errors, or " aberrations," of one lens or set of lenses is counterbalanced or " compensated " by opposite errors produced by the other lenses. Negative lenses are introduced for this purpose, as their errors are generally of an opposite nature to those of positive lenses. The optician attempts to thus compensate all aberrations, but when the perfect balancing of the errors proves impossible he makes use of a " stop," or " diaphragm," which is virtually a perforated screen with which very erratic and quite uncontrollable light rays can be obstructed or " cut out," while those that submit to control are allowed to pass. Such a diaphragm will eliminate the effects of most forms of aberration if the aperture is small enough, therefore it affords the easiest and cheapest means of making a lens produce passable results. Even a single uncorrected lens will do good work with a small stop put in just the right position; but, with any lens, the use of a small stop aperture reduces the quantity of light that passes the lens, which becomes " slow," or of low " intensity," and requires long exposures. If great rapidity and short exposure is necessary, the use of a small stop is impossible, and the optician has to use his utmost skill in applying the principle of compensation. He cannot do altogether without the stop, but he must place as little reliance upon it as possible for purposes of correction; hence the difficulty of making very rapid perfectly acting lenses and their relatively high cost.

TESTING CONDITIONS.

All the single lenses used in photographic combinations have either spherical or plane surfaces, and all,

together with the diaphragm, are centred on an axial line which intersects every surface normally: which means that it is at right angles to all the plane surfaces and passes through the centres from which all the others are struck. This line is called the " principal axis " of the lens, and any light pencil joining object and image points which are situated on the principal axis is des, cribed as a " direct " pencil, to distinguish it from the oblique pencils which have foci off the principal axis, In testing the quality of a lens we consider mainly its performance in representing a plane object upon a parallel image plane, both planes being at right angles to the principal axis. Fig. 2 will serve to illustrate these test conditions, for the line P Q is the principal axis of the lens L, while the object plane O, and the image plane B, are both at right angles to P Q. The pencil from P to Q is a " direct " one, while that from *p* to *q* is, of course, oblique. For experimental purposes pin-holes in O, with a bright light behind each, form good object points, and with this arrangement the aberrations about to be described can be easily identified.

CURVATURE OF THE FIELD

With a test object such as that just described, every point in the object plane should be reproduced exactly in the parallel image plane. If this condition is secured the lens has a " flat field." but if not the image suffers from " curvature of the field," and when received on a flat plate cannot all be sharply defined at the same time. If you cannot get a direct pencil and an oblique pencil in focus at the same time the existence of curvature is manifest. If the field is curved with a plane object it may be flat with a curved object, but that is not " flatness of field " as commonly understood. The form of the field varies with the distance of the object, hence the test object should be placed at a distance likely to be

used in practice. It need not be far away, for, as a matter of fact, absolute flatness is only of vital importance when copying flat diagrams, etc. An ideal condition of flatness can only be secured with highly-corrected lenses that produce perfect image points.

CHROMATIC ABERRATION.

This is one cause of ill-formed foci. The light emitted by any natural object is always mixed light that can be analysed into light of very various colours, and as an uncorrected lens always performs such an analysis it represents one object point by a number of differently coloured image points at various distances from the lens, some being visible and many invisible. When visually focussing an object in the camera we place the focussing screen in the plane of the visible image points. The plate, which is afterwards substituted for the screen, is, however, very little affected by the visible rays, the developed image being formed almost entirely by invisible "actinic" or chemically active rays; hence, if chromatic aberration is present, the plate is in the wrong place and the resulting negative is blurred. The actinic rays come to a focus nearer the lens than the visible rays (provided the aberration is not over-corrected), and we can roughly adjust the plate to the former by pushing it nearer the lens; but in a corrected lens both visible and actinic rays have the same focus, and no such adjustment is necessary. A corrected lens is styled "achromatic," or "apochromatic" if corrected for more than one set of actinic rays. With an uncorrected single lens the actinic focus is about 2 per cent. nearer the lens than the visible focus, but the latter focus is the nearer in an over-corrected combination. The test for achromatism is to focus carefully, then expose and develop. If the developed image is as sharp as the visible one the lens is achromatic.

The most convenient object for this test is a printed surface slightly inclined so that each line of print is at a different distance from the camera. If we focus on one line but find another is the sharpest in the developed image chromatic aberration obviously exists.

SPHERICAL ABERRATION.

If we can get nothing but a blurred image of a point, wherever we put the plate, then spherical aberration, or some phase of it, must exist. In a direct pencil this aberration can exist only in its simplest form, the effect of which is a circular blur. This may be a disc, or an ill-defined bright spot surrounded by a feeble blur, or a bright ring around a comparatively dark space, or a similar appearance with the addition of a bright spot in the centre. These different effects appear as the screen is moved to or from the lens, and the bright spot with surrounding blur is the best focus attainable. The ring with dark centre is most characteristic, and if it is found nearer the lens than the best focus the aberration is under-corrected and styled "positive," while if the ring is beyond the focus the aberration is over-corrected and "negative." Any cheap form of photographic lens, it removed from its mount, will show these effects on a fairly large scale.

ASTIGMATISM.

When a focussing screen intersects an oblique pencil in a certain place a point may be represented by an oval pointing towards the principal axis of the lens. Moving the screen slightly, another oval is then found with an axis at right angles to that of the first one, and somewhere between these two ovals the point is represented by a disc. These appearances can usually be observed with any cheap so-called "rectilinear" doublet lens, and they are a sign that spherical aberration is complicated by the effect known as astigmatism, which, with photo-

graphic lenses, can be produced in oblique pencils only.

The two ovals are the astigmatic foci of the oblique pencil, and the disc is the mean focus. The oval pointing towards the principal axis is the "secondary" or "radial" focus; the other is the "primary" or "tangent" focus. If the primary focus is nearest the lens, then the aberration is under-corrected or "positive," but if the foci are reversed it is over-corrected or "negative," this being the usual state of affairs.

As there are three foci in each oblique astigmatic pencil there must be three image fields. One is formed by radial foci, and in it an object line radiating from the principal axis will be fairly well defined, because each point of the line is extended mainly in a longitudinal direction. A line at right angles to a radial line, or a tangent line, will, however, be blurred, as each point is extended laterally. In the image field of the tangent foci radial lines are blurred laterally, while tangent lines are comparatively sharp. In the field of the mean foci all lines are equally blurred to a small extent, as every point is represented by a disc. Only one of the three fields can be flat, and if that is either the radial or tangent field, then only lines running in one particular direction can be in focus on a flat plate; it is, therefore, preferable that the mean field should be flat if the astigmatism is not corrected, and a flat mean field is the condition usually aimed at by the optician.

When astigmatism is perfectly corrected there is, of course, only one image field, which may be either curved or flat, and good definition will be possible in any part of that field if the removal of the astigmatism leaves no residue of spherical aberration. A corrected lens is now generally styled an "anastigmat," but the name only is new, not the condition that it expresses. The modern anastigmats are distinguished by the fact that



Volendam

EHC

BY EDGAR H. CARPENTER.

they are rapid and have a flat field, whereas the older ones when rapid had a violently curved field that rendered them practically useless, and a flat field anastigmat was extremely slow. The only well-known specimen of the old type of anastigmat belongs to the second class, and is called the Concentric lens. It is a very fine lens so far as correction is concerned, but its aperture is only about a quarter of the diameter of that of a modern anastigmat. New methods and new materials have enabled opticians to overcome the defects that once appeared to be inevitable, and the modern anastigmat is not only of extreme rapidity, but well corrected for all errors.

COMA.

This only occurs as an additional complication of astigmatism, and therefore in oblique pencils alone. It may be identified by the lateral distortion of what should be symmetrical astigmatic foci, either inwardly towards the principal axis, or away from it. The primary focus becomes a lopsided oval, while the secondary focus develops a wing or pear-shaped projection at one end of the oval. Coma is an inexcusable defect in a complete photographic objective, as it is the easiest aberration to correct. It can be readily observed with any single positive lens used without a stop.

DISTORTION.

A lens may be comparatively free from the defects hitherto described and yet draw untruly. The various foci composing the image are then incorrectly situated relatively to each other; hence the image is distorted. A common result of distortion is the curvature of straight lines situated near the margin of the view. A square may be represented with concave or convex sides, the first effect being known as "cushion" distortion and the second as "barrel" distortion. The absence of

either effect is, however, no proof that the lens is free from distortion, for curvature may be imperceptible even when a considerable amount of distortion is really present. The cause of distortion is the non-existence of a true station point, which fault, as before implied in reference to the pinhole, involves both untrue drawing and wrong perspective, and the best test for distortion is to check the truth of the perspective. Tilt the camera upwards to a good angle without shifting the lens from its usual position, set the swing back perfectly vertical with a plumb-line, then focus on a subject with long truly vertical lines. If these are perfectly parallel in the image the perspective is true, but if they are not the station point is defective, and the lens is incapable of drawing correctly under any conditions. Certain lenses that show no curvature in ordinary circumstances will show most alarming distortion with this test.

FOCAL LENGTH AND CONJUGATES.

Before a lens can be used to advantage certain facts concerning it must be known to the user.

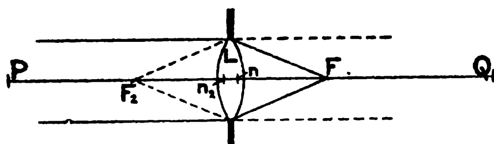


FIG. 3.

The focus of a very distant point lying on the principal axis of the lens is known as a "principal focus," and every lens has two such principal foci—one, F in fig. 3, for the direct parallel pencil travelling from left to right (in the diagram) and another, F″, for a pencil travelling from right to left. If the object point is brought nearer the lens, say to P, its focus moves in the same direction, from F to Q. These two points are called conjugate foci. They are reversible, P being the image of Q when Q is

the object, and the position of each is fixed absolutely by that of the other. When the point P is at one particular distance from F″ the image Q is at an equal distance from F, and the distance P F″ or Q F is the "focal length" of the lens, which dimension is a most important factor in all calculations relating to the adjustments of the camera.

If we set out towards the lens distances equal to the focal length from both F and F″, we arrive at two points, *n* and *n*″, called "principal points," and while F″ and *n*″ may be distinguished as the front principal focus and principal point respectively, F and *n* may be called the back principal focus and point.

The position of object or image may be fixed by its distance either from principal focus or principal point. A measurement from the former point is the extra-focal distance of the object or image, but one from the principal point is distinguished as the focal distance, and a pair of such focal distances are called conjugates. If we multiply a pair of conjugate focal distances together and divide the result by their sum the quotient is the focal length of the lens. This equation represents the "law of conjugate foci," from which we can always find one distance if the other two are known. The extra-focal distances are, however, connected by a simpler rule which is much more easily applied, and of much greater practical use.

Each extra-focal distance is equal to the square of the focal length divided by the other extra-focal distance. Thus the distance P F″ in the fig. is equal to the square of the focal length divided by Q F (all of course in inches), while Q F is equal to the square of the focal length divided by P F″. Supposing the extra-focal distance of the object, or P F″, to be 10 ft and the focal length of the lens to be 6 in., then the extra-focal distance of the

image, or Q F, is 36 in. divided by 120, or three-tenths of an inch. The rule can be thus applied to set the plate at the right distance from the lens when the distance of the object is known. Knowing the extra-focal distance of object or image you can at once arrive at the focal distance by simply adding one focal length. In the above example the focal distance of the object is 10 ft.×6 in., and that of the image 6 in.×three-tenths of an inch.

SCALE OF IMAGE

Focus being secured, the relative linear proportions of image and object are equal to those of the relative conjugate focal distances. Thus image and object are the same size when they are equally distant from the principal points, while if the focal distance of the image is one-third that of the object the image is one-third the size of the object.

The ratio of image to object is also equal to that of the extra-focal distance of the image to the focal length, and to the ratio of the focal length to the extra-focal length of the object. That is to say, if the image is one-third the size of the object, F Q (in fig. 3) is one-third the focal length, while P F″ is three times the focal length. The size of the image, therefore, varies directly with its distance from the back principal focus, and inversely with the distance of the object from the front principal focus If you halve the latter distance you must double the distance of the plate from the back principal focus to secure definition, and the image is then doubled in size.

These rules are of great importance in practical work. Suppose, for example, we wish to copy a diagram or negative on the scale of one-quarter full size. With a 6-in. lens we must set the object four focal lengths, or 24 in. from the front principal focus of the lens, and the

plate one-quarter of a focal length from the back principal focus—that is $1\frac{1}{2}$ in. If, however, we wished to enlarge the image four times we should set the object one-quarter of a focal length from the front principal focus, and the plate four focal lengths from the back focal point. Or, having once set up the camera, if we wish to alter the scale slightly—say reduce the image to three-quarters its present size—we reduce its distance from the principal focus in the same ratio and increase the distance of the object in the inverse ratio, which means that we multiply it by four-thirds or add one third. It should be noted that such adjustments can seldom be made so accurately as to ensure perfect focus—they must be supplemented by visual examination of the image.

With different lenses used upon an object at a fixed *focal* distance the size of the image varies with the focal distance of the plate from the lens. In the case of very distant objects the plate is placed at the principal focus, and the size of the image then varies directly with the focal length of the lens. Thus an 8-in. lens will produce an image just twice the size of that formed by a 4-in. lens, if the object is distant. With a near object the camera has to be racked out to secure focus, and size then depends on the focal distance, which is greater than the focal length.

MEASUREMENT OF FOCAL LENGTH.

If the position of the back principal point of a lens is known, then by focussing on a distant object and measuring the distance from screen to principal point you find the focal length. If the principal point is not known, focus on a distant object, and then rack out and focus on a near one, measuring the extra extension. Then determine the ratio of *object to image,* multiply the result by the extra extension previously found, and the

result is the focal length. It is convenient to use a finely divided scale as the test object, and then measure the image either with the same scale or another exactly similar. As an example, suppose we find that the extra extension of the camera is 2·4 in., and the object is two and a half times the size of the image; then the focal length must be 2·4 multiplied by 2·5 in., or 6 in.

APERTURE.

The next important particular that must be known with regard to a lens is its effective aperture, or the size of the largest parallel pencil of light that the lens and stop together will pass. Knowing this for each stop we can estimate relative exposures with different stops, for the amount of light passing the lens varies with the area of the pencil, and the exposure must vary inversely with the amount of light. For example, if we so alter the aperture as to double the area of the light pencil twice as much light passes and only half as much exposure is required. As the area of the aperture must vary with the square of its diameter it is sufficient to know the diameter only, and this dimension is best expressed as a fraction of the focal length. This, therefore, is the meaning of the fractions *f*/8, *f*/11, *f*/16, *f*/22, etc., by which the apertures of lenses are always represented. The *f* stands for focal length and the fraction simply denotes that the effective aperture is $\frac{1}{8}$th, $\frac{1}{11}$th, $\frac{1}{16}$th, etc., of the focal length. The denominator of the fraction is the "ratio number" of the stop

An *f*/8 aperture is naturally twice the diameter of an *f*/16 aperture; it is, therefore, four times the area, passes four times as much light, and requires one-fourth as much exposure. An *f*/11 aperture (really *f*/11·3) is half the area of *f*/8 and twice that of *f*/16. Therefore, by changing from *f*/8 to *f*/11, or from *f*/11 to *f*/16, we

reduce the light by one-half and must double the exposure. These stops belong to a universally useful series in which each stop requires twice the exposure of the next larger one, the series being *f*/4, *f*/5·6, *f*/8, *f*/11·3, *f*/16, *f*/22·6, *f*/32, *f*/45·2, *f*/64. The stops in modern lenses belong to this series, with the occasional exception of the largest stop, which, in rapid lenses, being simply the biggest one that can be used, will not always fit in.

The effective aperture is the size of the hole in the stop plate only when the stop is in front of the lens. To measure the true effective aperture in other cases first focus on a very distant object, then replace the focussing screen by some sort of thin opaque screen perforated in the centre with a small pin-hole. Put a bright light behind the pin-hole, then lay a piece of ground-glass flat against the hood of the lens, and measure the diameter of the circular disc of light seen on this little screen; this will be the diameter of the effective aperture.

The effective aperture for a distant object forms the basis of calculations in the case of near objects, but the result is sometimes wrong owing to the fact that, with certain lenses, the effective aperture really varies with the distance of the object. To test whether the aperture is thus "inconstant" or not, measure it just as described above, first with the lens in its usual position, and then again with the lens reversed so that the hood points to the pin-hole. If the two measurements agree the aperture is constant for any distance of the object, but if the first measurement is larger than the second then the aperture is smaller for near objects, while if the second measurement is the greater the aperture increases with near objects. Excepting with a few lenses of very special type, inconstancy is only a matter of moment when copying or enlarging, for which work an inconstant lens is not at all desirable. With certain lenses, however,

inconstancy is so great that it must be allowed for ; the "Telephoto" lens being a notable example.

EXPOSURE.

When the aperture alone is varied exposure varies with the square of the ratio number of the stop. Thus the relative exposures with $f/8$ and $f/16$ are as 64 : 256, or as 1 : 4.

If with the same stop we alter the focal distance from lens to plate by focussing on a different distance, exposure varies with the square of the focal distance of the plate. Thus, if we rack out the camera from 7 in. to 10 in. exposure must be increased in the ratio of 49 : 100, or must be approximately doubled.

When copying to various scales with any one stop exposure varies with the square of 1 *plus* the ratio of image to object. Thus if at one time the image is half full size and at another three times full size, exposures vary in the ratio of $(1+\frac{1}{2})^2$ to $(1+3)^2$, or in that of $2\frac{1}{4}$ to 16.

So long as the aperture has the same ratio to the focal distance of the plate exposure is constant, whether the same lens is used or not. Therefore with two different lenses both with $f/8$ apertures and both focussed on distant objects exposure is equal, but if one lens is focussed on a near distance the camera is racked out and the focal distance increased, and then a longer exposure is required.

Relative exposure with pin-holes may be calculated in the same way as with lenses, the distance of plate from pin-hole divided by the diameter of the latter being the "ratio number."

To a certain extent the rapidity of lenses varies, apart from inconstancy, with the materials used and sundry small structural details, but the variation is generally so small that it can be neglected. Nevertheless, when a very large aperture is in use and an exceedingly brief

exposure is given the result may be affected to an appreciable extent by these small variations, and this is a matter of some moment to those who have to deal with high-speed work. Some lenses at *f*/6·5 seem to be quite as rapid as others at *f*/6, but the differences are more marked when apertures of between *f*/4 and *f*/5 are in question.

DEPTH.

Strictly speaking only one object point out of a series of points all at different distances from the camera can be in focus at one time; but, practically, no want of sharpness can be detected in the other points provided their images are not blurred beyond certain limits. If we fix such a limit of " maximum permissible confusion " we can express definitely the positions of the nearest and farthest points in approximate focus, and so gain a clear idea of the " depth of field." Thus in fig. 4 if the lens L produces a sharp image Q of a point P, then other



FIG. 4.

points within a depth *c* to *d* will also appear to be in focus, and the positions of *c* and *d* can be fixed if we decide on the maximum amount of confusion allowable. The point *c* limits near depth, or the distance from *c* to P, while *d* limits far depth or the distance from P to *d*.

We can fix any limit of confusion, but $\frac{1}{100}$ in. is generally the amount allowed, though a smaller limit, say $\frac{1}{200}$ in., is necessary if we want really acute definition.

As a rule it is most convenient to express depth by the extra-focal distances of the nearest and farthest points in sharp focus. Thus the depth shown in fig. 4

is best described by giving the distances of *c* and *d* from F, the front principal focus of the lens.

In the case of a lens focussed on a very distant object there is no question of far depth, near depth alone exists and when found it is described as the "hyperfocal distance" for the particular stop.

If the limit of confusion is $\frac{1}{100}$ in. the hyperfocal distance is always equal to 100 times the square of the focal length divided by the ratio number of the stop; thus with a six-inch lens and stop *f*/8 the distance is 100 times 36 divided by 8, which is 450 in. or 37½ ft. This hyperfocal distance serves several purposes. First, it is the distance of the nearest object in approximate focus when we focus sharply on an infinite distance. Second, it is the distance on which we should focus to obtain a maximum amount of depth of field, for when we so focus total depth extends from half the hyperfocal distance right up to infinity. Third, it is a constant factor in all calculations relating to depth, and may be truly described as the "depth constant."

To find the limit of near depth when focussing on a near distance, with a lens of constant aperture, multiply the distance by the depth constant and divide the result by the sum of the distance and the constant. Far depth is found by multiplying the distance by the constant and dividing the result by the difference of the distance and constant. Thus if the constant is 30 ft. and we focus on a distance of 10 ft., the distance of the nearest object in focus is thirty times ten divided by thirty *plus* ten, or 7½ ft., while that of the farthest distance in focus is thirty times ten divided by thirty *minus* ten, or 15 ft. These results are only correct for the centre of the image excepting with well-corrected "flat field" lenses. The following table of constants may be useful:—

HYPERFOCAL DISTANCES OR DEPTH CONSTANTS FOR STOP *f*/8.

Focal length in inches ..	4	4¼	4½	4¾	5	5¼	5½	5¾	6
Depthconstant in feet	17	19	21	24	26	30	32	34	38

If we divide the constant by 2, 3, 4, 5, etc., in succession, we get a series of distances of "consecutive depth," such that if we focus on any one of them the two adjacent dimensions are the nearest and farthest distances in focus with the stop for which the constant is calculated. Thus, if the constant for *f*/8 is 30 ft., we get the series, 30, 15, 10, 7½, 6, and 5 ft., and if we focus on, say, 7½ ft. with *f*/8, depth extends from 6 ft. to 10 ft. If we use *f*/16, depth is shown by the second dimension from the distance in focus, so that focussing on 7½ ft. with *f*/16, depth extends from 5 ft. to 15 ft. On this principle a depth-indicating focussing scale can readily be set out.

With inconstant lenses depth varies slightly from the theoretical amount, while if spherical aberration exists it may vary to a large extent. Generally speaking, positive spherical aberration reduces all depth distances, while negative aberration increases them.

The greater the aperture and the greater the focal length the less is the depth available. Hence, when great rapidity and considerable depth are both desirable qualities, as in hand-camera work, a lens of short focal length is absolutely essential.

FOCUSSING SCALES.

When focus is secured on a certain distance the exact camera extension can be recorded by a mark on some convenient portion of the apparatus, so that the camera may be again set to the same mark when the same distance is to be focussed upon. A series of such marks

forms a focussing scale, but it is not usually possible to fix all the marks by trial, and some have to be determined by calculation. It is easy to find the mark for an infinite distance by focussing on a very distant object, and also one or two marks for near objects at extra-focal distances of from 5 to 10 ft. from these marks; others can then be found by the following rules:—The distances represented by any two marks on the scale are inversely proportional to the respective distances of those marks from the infinity mark. Thus, if the infinity mark and the 5 ft. mark are both determined a mark half-way between the two represents 10 ft., and one half-way between the infinity and 10 ft. mark represents 20 ft. A number of marks may thus be set out by dividing the space from the infinity mark to that for 5 ft. by different factors.

The actual extension of the camera beyond the infinity mark is always equal to the square of the focal length divided by the extra-focal distance of the object in focus, all dimensions being in inches, and by this rule we can set out marks for any distances when the infinity mark alone is known.

The most convenient series of distances to show is the one of "consecutive depths" before described. The infinity mark is, of course, included in this series, the scale marks for which are all equal distances apart. Allowing for a circle of confusion of 1/100 in., each division of the scale is equal to 1/100 in. multiplied by the ratio number of the stop for which the series is calculated. Thus, with a series of consecutive depths for *f*/8, each division is ·08 in.

TYPES OF LENSES.

A wide-angle lens is one that passes light pencils of exceptional obliquity, and its image field will, therefore, cover an exceptionally large plate. It must have a

short mount to allow very oblique complete pencils to pass, and must be specially well corrected, as aberration tends to increase with obliquity. Exceptionally wide-angle lenses are usually slow, as very oblique pencils will only give decent definition with small stops; big pencils are also more liable to be mutilated by the obstruction of the mount, which means a loss of light near the margins of the plate. As a rough guide to the angles called "wide" or "narrow," we may consider a lens to cover a wide angle when the greatest dimension of the plate that it covers is equal to or less than its focal length, while if the greatest length of the plate covered is less than two-thirds the focal length the angle is narrow. A wide-angle lens can, of course, be used at a narrow angle on a small plate.

Doublet lenses consist of two separated lenses with a stop between; "single" lenses usually consist of several lenses in close contact with a stop on one side of the combination. "View" or "landscape" lenses are of the "single" variety, are usually very imperfectly corrected for astigmatism and distortion, and only cover a medium angle with a small stop; they are therefore slow. They are invariably inconstant, but the variations in aperture are so small that they may be disregarded excepting when copying or enlarging, for which purposes such lenses are not well adapted, though often used. Their titles suggest the work for which they are most suitable.

Doublets styled "Rectilinear," "Symmetrical," "Aplanats," or "Euryscopes" are constant and corrected for most errors except astigmatism, which always exists in greater or less quantity. Most will cover a medium angle with $f/8$ and a moderately wide angle with a small aperture. Some will open out to $f/6$, but will then only cover a very moderate angle.

If the mount is short enough, a very wide angle can be covered with a small stop, but in such a case the marginal definition is somewhat imperfect. Anastigmats are the only lenses that will cover wide angles perfectly, and many of them will do so at a relatively large aperture. High rapidity and good correction over a large field are their characteristics, but it should be noted that cheaper types will do equally well if neither a wide angle nor extreme rapidity is required. A mid-angle lens that will work well at *f*/8 is good enough for most ordinary purposes. The flatness of field that anastigmats possess is of advantage mainly in copying, and not by any means essential for other work. Apertures of *f*/6 and over are only required for extremely rapid shutter exposures or for short exposures in bad light. The Cooke, Aldis, Collinear, Planar, Unar, Tessar, Protar, and Homocentric lenses are anastigmats, though the fact is not indicated by their names.

Portrait lenses are doublets of extreme rapidity (*f*/4 or thereabouts), highly corrected for direct pencils but not for oblique ones, the perfection of which is sacrificed for the sake of rapidity, and is not really of much moment in portraiture. They often show considerable distortion.

The Grün lens is of the most extreme rapidity, and is specially intended for short exposures indoors. The rapidity is gained by peculiar construction, and at the sacrifice of acute definition. It is a doublet lens filled with a special fluid, and is therefore heavy. Its advantages are, that it is apparently more rapid, and also gives greater depth than other lenses of similar aperture.

Uncorrected lenses are sometimes used for the sake of soft definition. Simple lenses with a stop are thus employed, while the " Bergheim " is a very special type of uncorrected doublet of adjustable focal length.

The Telephoto lens is one designed to work with a short extension of the camera and an extreme focal length. The focal length is adjustable, and when set to, say, three feet the camera extension may not exceed one foot, the principal point being a long way in front of the lens. The mount being very long, only a small angle is included, hence the lens can only be used on small plates, though it produces very large scale images. The only aberration likely to appear is distortion, and, though curvilinear effects are not often met with, perspective may be badly distorted with some patterns of the Telephoto. The Adon is a rapid variety of Telephoto lens of a rather more convenient pattern. All Telephoto lenses are very inconstant, so much so that with near objects the ordinary rules of exposure, etc., will not apply. Special rules are therefore adopted.

The lens is adjusted to produce an image on the required scale by altering the separation of the front and back combinations, the former being a positive doublet of ordinary type, and the latter a negative combination which magnifies the image formed by the front doublet. The ratio of magnification varies with every adjustment, but is easily determined with the aid of a scale on the lens mount. By considering first the action of the front lens alone, and then multiplying all essential factors (such as aperture No.) by the magnification, the effects of inconstancy are eliminated.

Supplementary lenses are single lenses added to ordinary photographic combinations to modify the focal length and size of the image. If themselves of great focal length and thin in substance, they do not materially disturb the corrections of the other lens. A negative lens increases focal length by slightly counteracting the convergency of the light pencils, while a positive lens has the opposite effect, and shortens the focal length.

The change effected can be estimated by the following rules. Two lenses in contact have a focal length equal to the product of their focal lengths divided by the sum, the focal length of a negative lens being treated as a minus quantity. Two separated lenses have a focal length equal to the product of their focal lengths, divided by their sum *minus* the amount of separation, which is the distance between their principal points. Two single lenses close together are practically in contact, but a single lens cannot be placed in contact with an ordinary doublet of the "rectilinear" type; there must always be a separation equal to at least half the length of the doublet, wherever the supplementary lens is placed. The most convenient position for a supplementary lens is generally the front of the original lens, but a negative lens is best placed at the back, as a smaller extension of the camera is then required.

With a fixed focus camera unprovided with any focussing arrangement a positive lens can be added to shorten the focal length, and thus bring near objects into focus. A supplementary lens used for this purpose is often called a "magnifier." Its focal length should be equal to the distance of the near object, hence a set of Magnifiers is generally required.

C. Welborne Piper.



The Hand Camera.

AN ELEMENTARY ARTICLE ON ITS MANIPULATION.



AMONGST the very large number who have acquired a hand camera, either as a means towards securing records or perpetuating memories of summer holidays, it would be interesting to know what proportion have studied beforehand the literature pertaining to the subject of hand-camera work. Probably very few, and it therefore seems superfluous to give advice on the type of camera to buy, as it is more than likely that the reader will be already the happy possessor of one of the various makes on the market at the present time.

Instead then of advising "what to buy" we shall endeavour in the next few pages to give advice on matters learnt by actual experience and practice, and such, we hope, as may be of practical use to the beginner.

It is only comparatively recently that the hand camera has come so prominently to the fore, both as an adjunct to a summer holiday, or as an important accessory to the picture-maker's outfit.

This is partly owing to the great increase that has been made in the sensitiveness of the dry plate, the introduction of the daylight loading rollable film, and the production of small but highly efficient folding and box form cameras.

Each of these two distinct types has its good points, and having employed at various times one or the other, it is difficult to say which is preferred. The most obvious advantages of the "Box Form" or magazine camera are, that it is always ready for use, usually in focus, and the plate or films *in situ* ready for exposure. For the purposes for which this class of camera is intended and is in fact mostly used—street scenes, groups, etc., etc.—these are important advantages; and, moreover, the simplicity of its mechanism gives the beginner little chance of going wrong.

The folding, or, as they are often called, "pocket" cameras have also very distinct advantages; the method and ease of loading in daylight with rollable film makes an instrument of this type almost a *sine qua non* for long tours when cumbrous impedimenta are inadmissible. To the more advanced worker, too, the focussing scale, which will admit of a general view or a "near to" one of a single figure or group will naturally appeal. Its extension will often permit of the use of either the double or single combination of the lens, which to the worker with some experience is a very necessary feature. These, then, are just a few of the various points that have gained for one or the other of these two types of hand cameras such a wide-spread popularity. Were it possible to combine the advantages of both in one, something approaching an ideal hand camera would result. The other hand cameras most in use at the present time are but variations of these two, which may almost be looked upon as primary types. The differences in the several parts of the camera are, however, numerous. The lens may be fixed or focussing; the shutter may operate directly in front of, between or behind the lens, or as in the case of the focal plane directly in front of the sensitive film; the methods

employed in loading are many, and may be for plates or films in sheaths or in dark slides, films in packs or rollable film, and so on.

Perhaps, however, a more distinctive feature in the cameras of the more expensive kind is what is known as the "full-size finder." It is a contrivance with which one is enabled, by means of a reflector, not only to see the object on the screen, but to focus right up to the moment of exposure. For figure work, where the correct composition is the desideratum, and for rapidly moving objects this form of camera has no equal; unfortunately, however, in the former class of work it is, by reason of its rather conspicuous appearance, apt to attract more attention from the "victims" than is quite desirable.

With these few brief remarks let us now pass to what will be of perhaps more interest and use to the reader.

THE HAND CAMERA IN USE.

We will suppose that you have one of the two types of camera briefly referred to above, and that at the time of reading this you are to a more or less extent ignorant both as to its powers or its manipulation. First and foremost in importance is the lens. It is to the quality of this essential feature that the technical excellence of your negatives will be mostly due. The beginner who has recently acquired a small camera for say half-a-guinea must not expect his instrument to be fitted with a lens that will have such wide capability as one fitted with the considerably more costly anastigmat, but nevertheless if he will from the very commencement recognise just how much his lens may be expected to achieve, he will be well along the path toward securing satisfactory negatives.

The first point that the amateur ought to be conversant with in regard to his lens is what is generally called

"the working aperture," and which means the size of the circular opening of his lens with which a perfectly sharp image to the extreme corners of the size plate in use can be obtained. With the more highly efficient lenses of the present day this working aperture might be *f*/5, *f*/6, etc., with the cheaper varieties, however, it is usually that known as *f*/11; but for an explanation of these terms and further information the reader is referred to the chapters in this book on "Lenses," and on "Negative-Making."

As will be readily understood, the smaller the aperture is the less the quantity of light that can pass through in a given time; therefore, in knowing the size of this aperture, we shall have to commence with the first factor that helps towards correct exposure, and consequently a rough idea as to when that exposure is likely to be efficient. Next in importance to the lens is the shutter. There are of these a countless variety used on the hand cameras of the present day, and but little service would be rendered to the reader by a detailed description of any. He has his camera, and with his camera his shutter, and he naturally wants to make the best of it. The best possible advice that can be given him is to find out, as with his lens, its range of capability, in other words its varying speeds. On purchasing a camera one may be told that this or that shutter gives a range of exposures from 1 second up to $\frac{1}{100}$th, or that another gives time and instantaneous exposures. Probably the latter is more truthful, for the instantaneous may be anything from $\frac{1}{15}$th second to $\frac{1}{50}$th. Too much reliance should not be placed on these statements, and we would urge the possessor of a camera with an unknown shutter speed to make himself acquainted at the outset with an approximate idea of its rapidity. From time to time there have appeared in the photographic

press many descriptions of means, more or less complicated, by which one may test by experiment the speed of his shutter. One such method which needs no special apparatus was described in the "Amateur Photographer" of February 19, 1903, and was found by actual trial to be far simpler perhaps than it reads. The method, somewhat condensed, is here given.

Turn a bicycle upside down and place in front of a dark background; place a piece of white paper to cover the interval between three spokes of the driving wheel near the rim, use a fast plate in the camera, which latter should be placed as near the cycle as is practicable, the ground glass being parallel to the plane of the wheel. Let a friend now turn the crank at some known rate. Then take a photograph and measure the streak made by the paper on the resulting negative The speed of rotation of the wheel is known, the angle through which it turns in a second is known, and a comparison of this angle with the angle through which the wheel has turned, obtained by measuring the streak in the picture, will give the time of exposure. There *is* a simpler way. Carefully pack and send to one of the well-known dealers with instructions to test speed of shutter. There is one well-known London house at least which undertakes to scientifically test the speed of any shutter for a nominal charge of a few pence. Anyhow, either way will do as long as you find the speed.

Knowing now the working aperture of your lens and the speed of your shutter, it but remains to choose just that plate or film which, under the conditions in which you will work, is of just a sufficient rapidity to ensure a correct exposure. It will be necessary here to call the tiro's attention to the fact that at the present day plates and films can be bought of a widely different degree of sensitiveness, and that all the recognised

brands on the market have what is known as a speed number. The speed number is higher or lower according to the sensitiveness of the emulsion with which the support is coated. Again, all which are styled "extra rapid" are not of the same degree of sensitiveness. An exposure that would be amply sufficient for one brand might not be correct for another. It therefore behoves the beginner to make a choice of one plate, and as far as possible to use that one plate only; one of the greatest mistakes made by the majority of beginners is changeableness in reference to the plates used. All plates have their little idiosyncrasies; some develop slower and gain density quicker, others *vice versa*, and it stands to reason that little knowledge and fewer good negatives will be secured if the beginner hover between several brands of plates of widely different characteristics.

The next and most important point of all to the hand camera man, in so far as correct exposure of his plates is concerned, is knowing the strength of the light. Light at various times of the day or year is said to be either more or less actinic; in other words, a considerably shorter exposure is required for, say, middle day of June than it is, to give an extreme example, the same time in December. As this actinic power of light is difficult to judge, and very difficult to judge by the eye, recourse is had by a large number of photographers, especially those who use their cameras on a tripod, to a little mechanical device known as an "actinometer." Briefly described, it is a strip of sensitised paper, which on exposure to light darkens to a standard tint in a time varying with the strength of light; this gives a basis on which to calculate the necessary exposure.

Hand-camera work is, however, essentially out-of-door photography, and light conditions are considerably more equable, and a little judgment, coupled with the

high excellence and wonderful latitude in exposure that the modern day plate gives, makes it hardly necessary at the outset to advise the beginner for ordinary work to use an actinometer. Instead, however, there are many small useful pocket-books on the market which contain amongst other information tables that give the light values for each month; such a one is Wellcome's "Photographic Exposure Record." To the beginner it will be found of material assistance, exceedingly simple, and with a little judicious allowance for the varying conditions of subject, distinctly helpful as a guide toward a correct exposure. Here, for instance, is an example of the light table for May:—

	Sunlight.	Sun through light clouds.	Diffused light.	Dull.
9 A.M. to 3 P.M.	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$
8 A.M. and 4 P.M.	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$
7 A.M. and 5 P.M.	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$

These are the approximate exposures that would be required with an "ordinary" plate and a lens working at *f*/8; the subject to be photographed being described as one having a strong foreground, *i.e.*, a good deal of shadow near to the camera. With the plates of a speed that one would probably use in a hand camera—say Barnet Extra Rapid—the exposure would only be one quarter as long for the same subject, and if as well as the more rapid plate the subject itself was, we will say, a snapshot of figures on an open space without many dark shadows, a still greater reduction in exposure would take place. The principles of exposure are the same whether a hand camera or stand camera be used, and are treated at greater length in the article on Negative Making.

Knowing the aperture of your lens, the speed of your shutter, and the rapidity of the plate you are using, it now needs but reference to your "light table" for the month and hour to determine what length of time shall be given that will ensure correct exposure for any given subject.

Having found this correct exposure, the greatest difficulty toward producing a good negative is overcome. Other writers in this book will refer more specifically to the development of the negative, so that it is not proposed to give here any but a very brief description of this perhaps most interesting phase in photographic procedure. To those who are not developing their own exposed plates or films, let it be said at once and plainly that they are deliberately foregoing one of the chief pleasures connected with turning their photographic work to pictorial account. To watch a correctly exposed plate developing is a pleasure that never palls even on the oldest workers, and is the consummation that repays one many times for the trouble which making the exposure has involved.

Development is not difficult, and although, as time goes on, the worker as he becomes more experienced will use different developers for different subjects, it is not advisable for the beginner to vary his developer until he has gained sufficient knowledge to know when this course is advantageous. As a developer, a solution of Adurol can be strongly recommended. Properly compounded there is nothing messy or staining with it, and for ordinary everyday out-of-door work development may be purely mechanical. Such a solution is made up as follows:—

Carbonate of soda	5 ounces
Sulphite of soda	2½ ounces
Water	15 ounces

When dissolved add :—

Adurol .. .. ½ ounce

then filter through blotting paper and mark bottle—

ADUROL SOLUTION.

For use one part to seven parts of water.

This, if properly compounded, will give a clean bright solution, and will keep for a considerable time, and in prolonged development will show no tendency to stain. As hand-camera exposures generally betray a tendency to under exposure, the metol and hydroquinone one-solution developer given in " Negative-Making " deserves attention on account of its energy, whilst time of factorial development offers especial advantage in hand-camera work.

THE HAND CAMERA IN USE ON TOUR.

As probably the greater proportion of the readers of this short article are those to whom the summer holiday is or will be the most prolific in exposed negatives, some little space may be devoted to the preparations needful before starting on one's holiday. You are going away for a more or less extended period, and with your camera you are taking some dozens of plates or films ; it will also be necessary, if you are trying to do intelligent work, to take one or two little etceteras that may save you later on many heart-burnings. First of all be sure and take a small lamp—a fabric one that will fold up and burning a small night light will do, such a one costing but a shilling—some elastic bands, and some light-proof paper. If the photographer is especially methodical he may also take the few necessaries for developing and fixing one or two trial plates, so that he may see that everything is working satisfactorily. Owing to neglect of this the writer's holiday negatives

were all fogged owing to a slight damage, unseen, to the shutter, which in the bright sunshine of June allowed just sufficient light through to effectually fog some six dozen negatives ; had a plate been developed this fault would have been at once discovered and easily remedied. A spool of film may become jambed owing to uneven winding, and a dark-room lamp become to the daylight loading man an unexpected necessity.

In changing plates at night time the ordinary bed-room will do, taking care to see that no bright light, such as a gleam under the door or through the window from a gas jet outside, is in a direct line with the plates. Always pack the plates film to film, wrapped in their original papers and placed in their empty box ; make a distinctive note on the box as to where the plates were exposed, and an outline of subjects, thus :—

Hastings. Wednesday, June 16.
" Groups on Pier and Promenade."
Diffused light, *f*/8, $\frac{1}{50}$th second.

There is not much need in the earlier stages of hand-camera work to mark each plate, and in most instances these brief particulars on the plate box will be a sufficient guide.

If plates are being used, in reloading your camera, a sharp tap on the edge will dislodge any particles of dust ; never dust them with rags or brushes—this method is a productive cause of subsequent " pin-holes."

Another important item that the beginner would do well to observe is : place the order for whatever quantity of plates or films are thought necessary some time before leaving home. This means that you will get your plates fresh, and probably coated with an emulsion of a uniform speed, instead of a possible variety of makes of an unknown age and rapidity.

If it is to the seaside that you are going, there is no need to choose a very rapid brand of plates; indeed, you would be courting disaster were you to do so, a medium speed being ample for seaside work during the summer months. In our own practice we take one brand of plates of two speeds, half of medium rapidity, the other fast, or double the rapidity of the medium; these latter are used for street work or market-places, where their greater sensitiveness counterbalances the prevalence of shadow.

If you are a cyclist, and carry your camera with you, very stringent precautions must be taken to keep the inside of the camera free from dust, as owing to the constant jarring the mysterious dust particles have always the greatest predilection for the most important portion of the plate. The methods that have been advocated from time to time as to the best position for carrying the camera when cycling are many. Some will advocate a carrier on the handlebar; others will tell you that behind the saddle is the best place to carry the camera; but, notwithstanding just a little inconvenience in very hot weather, we strongly advocate the web strap and the camera slung across the shoulders —in this position the weight is hardly noticeable, and jarring quite obviated.

The next lesson may now suitably be called "Exposing the Plate."

We will suppose you have reached your destination, and, for example, we will say at a market-place. To the hand-camera man such a place is usually prolific in possibilities. The moving figures, the groups at the stalls, and the freedom from observation with which exposures may be made, are some of the factors that help to give the camera plenty of material to work upon.

Presence of mind and a quick eye for seeing suitable subjects are the two qualities that are needed in such a place. Don't get excited or impatient; make up your mind what you want and devote a little thought before releasing your shutter. If you have not already done so, work out the exposure that you think the subject demands, making the allowances that may be necessary, as, for instance, the distance at which you propose exposing, whether the figures are in the shade or not, etc. Next from afar note the position of the various items, such as baskets, etc.; see which will be the best position so that the subject is well lit. It is recommended that at first the sun should shine on the side of your subject or diagonally across your shoulders from the back, thus obviating any very pronounced shadow contrast, for it will be owing to the shadows that difficulty may arise in development—the old adage, "expose for the shadows and let the high-lights take care of themselves," is a good one for the beginner. Having now made sure that all is ready, stroll up to the selected position and quickly expose your plate, continuing along so that at the first opportunity you may change your plate or film unobserved. The great majority of failures in such work as this arise from the fault of the photographer attracting the attention of the market people to his movements. If he will persist in stalking about with his back bent and his eyes intent on the mirror or finder, he must not wonder if the market folk become interested in his "goings on," and his resulting negatives betray a group of people earnestly staring at the camera instead of in their characteristic attitudes of buying and selling. Probably this is all owing to the implicit reliance that is placed on the "view finder," which, after all is said and done, is seldom necessary. Given a little practice and a determination to dispense

with it, and it is astonishing how soon one can do without the finder altogether. Let the beginner train his eyes as "view finders," he will soon find by actual experience that he will be able to secure quite as good a selection of subjects, and without being nearly so liable to attract attention.

If it is found that the figures or group are painfully conscious of the presence of the camera, tact must be brought into play—be aggressively unconscious that one is attracting any attention whatever, and that photography is about the last thing that is being thought about. A pipe can be ostentatiously loaded, a placard on a hoarding can be studied; or, in fact, anything that may suggest itself to the "wily" man with the camera until watching his time the opportunity may come when a successful exposure may be made.

At first, even although giving only $\frac{1}{25}$th of a second exposure, you may find on development that the picture is blurred. This is because on rapidly bringing the camera into position you released the shutter before the camera was quite still. There is often this tendency to "shake" at the commencement of hand-camera practice. Practice, however, will give you the confidence that means being quite calm and self-possessed at the moment of exposure, and thereby securing a sharp image. Some operators will tell you to hold your breath as a cure, others will say deflate your lungs, and so on, and, like Mark Twain and his cures for a cold, you will try them all, and will, perhaps, succeed none the better.

If your camera is one of the folding type, and capable of different extensions, it is seldom advisable to work with the bellows racked out so that everything is in focus. This may be all very well when a sharp all over

general view is wanted, but it is, to say the least, a disadvantage from an interesting, as well as a pictorial, point of view, if in exposing a plate on a figure as close as ten to fifteen feet you also securet he detail in the architecture of some houses two hundred yards away. Just a slight blur amounting only to a softening in these latter would have thrown up more prominently the object photographed, and would do much to centre the interest.

Next there will come a time when photographs of rapidly moving objects such as trains, men walking, cycling, etc., etc., will be the reader's aim, and these owing to the more or less rapid movement will require a proportionately brief exposure. The little table herewith will give a rough estimate of the exposure necessary to secure sharpness :—

	Approaching	Moving at Right Angles.
Walking	$\frac{1}{40}$th second	$\frac{1}{120}$th second
Cycling, Pony and Trap	$\frac{1}{100}$th second	$\frac{1}{300}$th second
Horse Galloping, Trains	$\frac{1}{200}$th second	$\frac{1}{600}$th second

This table assumes that the camera is at a distance of at least forty feet from the object, and that the camera is a quarter-plate fitted with a lens of $4\frac{1}{2}$ in. focus. These exposures can be lengthened as one recedes farther from the object. It will be seen, however, from this how useless it is to attempt an exposure on a subject that requires say $\frac{1}{200}$th second, when the greatest speed the shutter is known to work at is $\frac{1}{50}$th second, also if calculation shows that at such a time of day, and with the plate in use, the only result can be gross under-exposure. Nor are these the subjects that the amateur with the ordinaiy outfit is well advised in attempting. The moving train, we know, always has a fascination for the beginner, but he should remember that even if he

can give a short enough exposure for a railway train travelling at fifty miles an hour, yet the result will seldom come up to his expectations, and an exposure ten times as long made on a train just starting will usually give an infinitely more pleasing result. Breaking waves are also another temptation upon which a little advice may be offered; about one-thirtieth of a second is the exposure required—a shorter exposure than this will destroy the signs of movement, and give the water a petrified look that is so undesirable. A dull day is often the best; sea foam and a blue sky have a tendency of both coming out white in the resulting print.

The varying heights at which it is best to hold one's camera can only be found by practice. To accentuate a single figure a height of three feet from the ground is about right; higher for a general view. A low view point is more often desirable than a high one—painters in fact nearly always take a low view point.

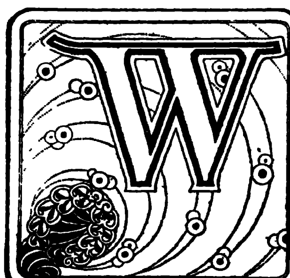
Having now made some few exposures, develop as indicated. You must not expect to get first-class negatives with every exposure—a little practical experience will teach you more than pages of letterpress. Go slowly at first, and do not be too lavish with your exposures, and when you get a good negative aim at turning out one really good print rather than dozens of mediocre ones. Study diligently the other articles in this book, for they all have a more or less direct bearing on the work of the hand camera. You will be well advised if, after some months of hand-camera work, and when you have mastered the smaller details of the craft, you make up your mind to specialise, and instead of snapping everything that comes along, from a breaking wave to a roadside cross, devote yourself to one type

of subject, so that in time you may become in this particular one better than the majority. Invest in a copy of a photographic paper weekly, and if possible become a member of a photographic society. In each case it will be money well invested, and don't give in because at first you may have some failures. Steady and persistent striving is the way that will lead to success in photography, as in everything else.

Edgar H. Carpenter.



Hints on Amateur Portraiture.



ERE the whole of this volume devoted to the subject of portraiture, there would, even then, not be room to say all that might be profitably said on this fascinating branch of photography. How scanty and imperfect, then, must be this little sheaf of notes, hints and jottings.

With the desire of conveying as much help and information as is possible in the limited space available, the present writer asks the reader's forgiveness for adopting a brief, compressed and somewhat disjointed style.

The experienced professional worker enjoying the advantage of a studio, blinds, backgrounds, reflectors, etc., is not likely to learn anything from a mere amateur. Therefore it may be said at the outset that the reader for whom these notes are primarily designed is presumed to essay his portraiture either in an ordinary living-room or out-doors. If is further assumed that the reader has a practical, if moderate, acquaintance with the steps of ordinary negative-making, *e.g.*, exposure, development, and so forth, but that his experience in photographic portraiture is a negligible quantity.

APPARATUS.

A hand camera may sometimes be used for outdoor portraiture—*i.e.*, full-length figure, groups, figure studies—but as a rule a stand (tripod) is desirable for several reasons. Not only does it enable one to give a generous

exposure, (*e.g.*, a second or more) without fear of the camera moving, but it enables one to fix upon a view point, leave one's camera, and go up to the sitter to arrange a fold of drapery, bit of foliage, etc., and return to the camera to see the effect of the change from the same view point as before. Also, the camera being properly placed one has no need to be thinking about whether we are aiming straight, holding it level, etc.

Focussing Screen.—A stand camera usually is provided with a ground-glass focussing screen, and for portraiture this has only to be used a few times to be appreciated. The *placing of the figure* is a matter of very great importance, and it is by no means easy to space out the picture quite satisfactorily when a small view finder is one's only means.

Swing Back.—It is sometimes thought that the swing back is only used in architectural work, but this is a mistake. For certain relative positions of camera and figure the swing back is, if not absolutely essential, at any rate highly desirable. Not only does it enable one to exercise some measure of control over the degree of definition (sharp focus) of various portions of the picture, but this at times enables one to use a larger stop—in other words, give a shorter exposure—than would otherwise be practicable.

A long extension of the camera bellows is another advantage soon appreciated, as it enables one to get nearer the sitter, or use a long-focus lens when a large scale picture is wanted. And incidentally it may be mentioned that the portraitist often wants to copy other portraits, when again a long bellows is greatly valued.

A rising front also is often of considerable help, enabling us to shift the "placing of the figure" on the plate without altering the relative position of camera and sitter. In fact we may roughly say that the rising front enables us to add or remove space above and below the

head, which is often equivalent to altering the apparent tallness or shortness of the sitter, a point which may have a good deal to do with conveying a truthful impression of the sitter.

The focal length of lens is one of the points where the beginner is apt to go astray. Very often he has but one lens of length suitable for ordinary landscape work. This, probably, has a focal length between 5 and 6 inches, in the case of a quarter-plate outfit. With an adult sitter 10 feet away the sitter's head, with such a lens, may be about $\frac{1}{20}$ to $\frac{1}{24}$ natural size—say, something less than half an inch long on the ground glass. This seeming too small, the photographer approaches his subject to get a larger scale of picture, and consequently gets a degree of distortion which increases as he gets nearer his subject. But by using a lens of longer focus a larger scale picture is obtained without going so near the sitter, and consequently without apparent distortion or proportion. If the reader has a long bellows camera and short-focus lens of the doublet type he can make all this clear to himself in a few minutes by a homely experiment.

Take any object, a vase, book, etc., about the size of an adult head, say 9 inches or so long. Set up the camera at 10 feet and focus the object with the 5½-inch focus lens. With a strip of paper applied to the ground glass tick off with a pencil the length of image of the selected object. Now remove one portion of the lens, *i.e.*, either the back or front half, re-focus without changing the position of object or camera, and again measure the ground-glass image. It is one thing to know that such and such "must," "will," "ought" to be so-and-so, and another thing to know from actual personally made experiment that it *is* so. Therefore this experiment should be made by every beginner in portraiture.

Choice of a lens naturally follows from what has just been said. The reader may be contemplating the purchase of a lens specially for this purpose, and asks for guidance on (1) focal length; (2) type of lens.

Focal length.—This must partly depend on whether he is "going in" for head and shoulders only or full length figures as well, The larger the scale the longer the focus from a given standpoint. Therefore a longer focus will be more useful for head and shoulders than for standing figures. Again, he must bear in mind the size of the room. A long-focus lens means that we need to get well away from our sitter, or we may not be able to get in as much of our subject as we wish to include. For outdoor work this consideration will not often trouble us. For half-length figures a focal length of double the length of the side of the plate will be found useful. Thus for a 4×3 picture the focal length may be from 6 to 8 inches.

Type of Lens.—This will in many cases be governed by a matter of costs, *i.e.*, how much the worker is disposed to pay for his lens. But in any case, as an amateur's advise to amateurs, let us say, Do *not* buy a portrait lens. They are costly, they are bulky, and in nearly every case one has to stop down so much that the quality for which the extra price is usually supposed to be paid, *viz.*, rapidity (large aperture), is annulled.

All things considered, we recommend a stigmatic lens of modern type. This usually works at about *f*/6·5, and often may be used at full aperture. Next come lenses of the rapid symmetrical type, working at *f*/8. For outdoor work these are quite quick enough for ordinary portraiture. Next cheaper are the single landscape lenses, working at *f*/11. Indeed, for a well-lighted room or a conservatory this type of lens holds its own against all others when soft definition is appreciated. Finally, we can get quite good portraits with ordinary spectacle

lenses, costing, unmounted, about 6d. each, provided we do not look for great speed or very sharp definition over a large area. These lenses can easily be mounted on a home-made card tube, with a fixed stop of blackened card. The meniscus form is the best; the concave side turned towards the sitter, and the stop between the lens and sitter. First ascertain the equivalent focus of the lens by focussing a distant object, and make the diameter of the circular opening of the stop $\frac{1}{16}$ of this equivalent focal length. As to the position of the stop, focus on a building and get a friend to shift the stop to and fro until you get the position of most even definition, illumination and least distortion.

The visual and chemical foci of such a lens will not coincide. Therefore, to get the sharpest definition on the negative, one must first focus as sharply as possible on the ground glass, and then bring the ground glass a "little nearer" the lens. How much this "little" is depends on the kind of glass and focal length and curvature of the lens. In general, we may reckon $\frac{1}{30}$ the focal length as the approximate correction. (This, for a 7-inch lens, would be $\frac{7}{30}$, or, say, $\frac{1}{4}$ inch). In portraiture, however, we do not want the sharpest possible definition for pictorial effect, and therefore we should only take about half this correction (say, $\frac{1}{8}$ inch with a 7-inch lens).

SIZE OF STOP.

The size of the stop to be used in portraiture and the degree of definition are matters calling for a hint or two for the beginner, who is often tempted to think that the sharper the definition the better the picture. This is by no means so, and especially in the case of portraiture, when a general impression is of far greater importance than any special detail. Let the reader pause a moment and attempt accurately to draw or describe the exact

shape of the features of any tolerably familiar acquaintance. It is easy to get as far as "a prominent nose, firm lips, laughing eyes," etc., etc., but when it comes to *exact* shapes, sizes, etc., what then? A friend may have a scar on his cheek; we may know its exact shape, size, colour, position, but it is not that which makes the portrait. True, it is part, but only one among many other factors. But an experiment will often convince when dogmatising raises antagonism. Therefore, let the reader take two portraits of the same sitter. Let one be "sharp-all-over," even to the collar stud and pattern of the tie, etc. Let the other be only just sharp enough to show shapes and forms, but *not* to show the threads of the draperies or single hairs in eyebrows, etc. Or, again, print a sharp-all-over negative on smooth paper and on rough, and let the comparison of results speak for themselves.

No rules can be laid down, nor are they desirable. It is better to look at one's sitter, and then slowly close one's eyes until just the desirable degree of softness of definition is seen through the partly-closed lids. Note this, and then aim to get this effect on the ground glass by changing the stop and using the focussing screw.

One principle seems of general application—*viz.*, that it is not good for pictorial purposes (landscape or portrait) to have such sharp or such fuzzy definition as to call attention to itself for either extreme. If one part of a picture be conspicuously sharp or out of focus as compared with the rest, this extreme part, by sheer force of contrast to the neighbouring parts, is apt to call (unworthy) attention to itself. Portrait and other lenses of large aperture are apt to have but little depth of focal field or depth of focus, and also some have curvature of the keld as well, so that with such a lens we may have one eye in a "three-quarter" portrait sharply defined, and the other eye almost unintelligible.

Or one part of a man's beard may look like pin-wire, and the other part like cotton-wool or smoke. Clearly such inconsistencies have only to be mentioned to be condemned. At the same time, a warning against the other extreme (monotony of definition) is equally called for. One of the symptoms of the early stages of the photographic epidemic is the all-absorbing desire to "get it all in sharp focus." We see cousin Kate or uncle Tom posed against a background of brick wall. The print shows us every leaf, every joint of brickwork, every button, every stripe of the garments. The total is a bewildering mass of irritating detail. The more the eye looks the more irritated it becomes. This naturally brings us to the vastly important question of

BACKGROUNDS.

It is not too much to say that the success or failure of a pictorial portrait is largely due to the background. One thing is certain, *viz.*, that it is not possible to make a good portrait without a good (*i.e.*, suitable) background. It therefore behoves the amateur never to lose sight of this factor. This point is here insisted on, because in the majority of cases the amateur's first portraits are obviously taken without any thought whatever being given to this matter. The victim is made to stand against a brick wall, with a bewildering number of lines or joints showing, or against a trellis-work screen, which may or may not be covered with ivy or some other foliage, where every leaf has a glittering patch of light to catch and irritate the eye. Or perhaps he stands in the middle of the lawn, with a fowl-pen or row of houses in the distance. If these are sufficiently sharp to be recognisable they appear as objects of ugliness, or if out of focus they form distracting blotches. If the experiments are made in a room we have perhaps a fidgeting wall-paper pattern, or irritating patches of

pictures on the wall, etc. There is only one rule to be laid down, *viz.*, that the background, whatever it may be, must not attract attention *to* itself, and therefore *away from* the portrait.

The background of a portrait, like the foundation of a building, should do its vastly important work unostentatiously. It may be light or dark, it may be plain, graduated, or have some pattern or design, but in no case should it compete with the portrait. Now the two things which attract the eye are extremes of definition (*i.e.*, sharpness or fuzziness), and extremes of chiaroscuro (light and shade). We must, therefore, be at some pains to avoid these extremes.

For example, if we have a portrait slightly softened in definition against a sharply-defined wall-paper pattern, or unintelligibly-out-of-focus object, then the background will assuredly attract to itself far too much attention. Or, again, if the portrait be sharply defined against an equally sharply defined background, then they will compete with each other, and the background, instead of attending to its own business and doing what its very name tells it to do, *viz.*, to keep back, will seem to come as forward as though it were on a level with the figure.

Then again, if our background exhibits strong light and shade contrasts it will unduly attract attention. For example, framed and glazed pictures on a wall often reflect strong light patches. Similarly the shiny leaves of foliage, patches of sky showing through openings of buildings, or leafage, etc.

Lininess is a quality better absent in a background. A gate, or row of palings, a wall showing regular lines of masonry, a bookcase, or panelled woodwork are better avoided, unless the worker has experience and skill enough to put them into a duly subdued tone, or light and shade value.

Contrasts.—In general, where strong contrasts are thought desirable, it will be found better to put a light figure against a dark ground, than a dark figure against a light ground.

Gradation.—The question of a flat (even in light and shade) or graduated background is a matter which must be left to the taste of the worker as the occasion may demand; both are useful and desirable. In general, it may be said that a slightly varied ground is more decorative and more likely to harmonise with and therefore help the figure than a flat ground, which, by its very monotony, may attract attention. Again, a background varying somewhat in light and shade enables one to accentuate a contrast here, or subdue a contrast there as occasion may demand.

In general, one may say that a ground if varied should have more of its light tones in the upper half, otherwise it is liable to give a top-heavy and dramatic effect—a style not uncommon in the crude early Victorian days.

The amateur will be wise to hesitate before spending much money in the purchase of commercially-made backgrounds. They are right and proper, and most useful in a properly-equipped studio; but for the domestic studio something more homely is preferable. We can only offer a few suggestions that may serve their intended purpose, *viz.*, of stimulating the reader to be on the look-out for things suitable and ready to hand. An open doorway often forms an excellent dark background. Again, by suitable choice of angle the door itself may be made to act as a graduated ground. Some excellent studies may be made with this hint as a starting point.

Curtains as free of pattern as possible and of a soft non-shiny material are often useful. A grey or yellow blanket again may be used often with excellent effect.

Brown paper some 5 ft. wide or so is sold in rolls at a few pence per yard (used for underlaying carpets): this makes an excellent background. A duster folded up into a ball and dipped into a plate of powdered whiting enables us to lighten one part, and lamp-black applied with another duster gives us a means of darkening others. The paper should be laid flat on the floor or nailed up against a flat wall. If the steam of a kettle of boiling water is allowed to play briefly on the applied white or black it will prevent so much powder falling off when the background is moved. A thin wooden lath should be nailed to the paper at the top and bottom. This prevents the paper tearing quite so readily.

Background stand.—We have not space to describe how this may be made, but content ourselves with the alternative hint that a *large* clothes-horse may be used, and our background fixed to this by means of a few tacks or drawing-pins. If a curtain is used it is convenient to have small brass rings sewn to its edges at six-inch intervals and hang these rings on to French nails. A material called "art serge" is made about 5 ft. wide, in various colours and at a moderate price.

Position of the background.—When working in an ordinary room one can alter the light and shade value of the ground by so turning it this or that way that more or less light falls upon it. This is a point of great practical importance. And to get this to full advantage the background should be as large as convenient, say 7 ft. high and not less than 5 ft. wide.

In general it is best to have the background a couple of feet or more away from the figure. This will serve as a reminder to get the background just slightly out of focus.

It is sometimes possible to arrange a small screen so that it casts a little shade on the background, and converts what might be a monotonous blank space into

something slightly more interesting, but not sufficiently so to detract from the portrait.

REFLECTORS.

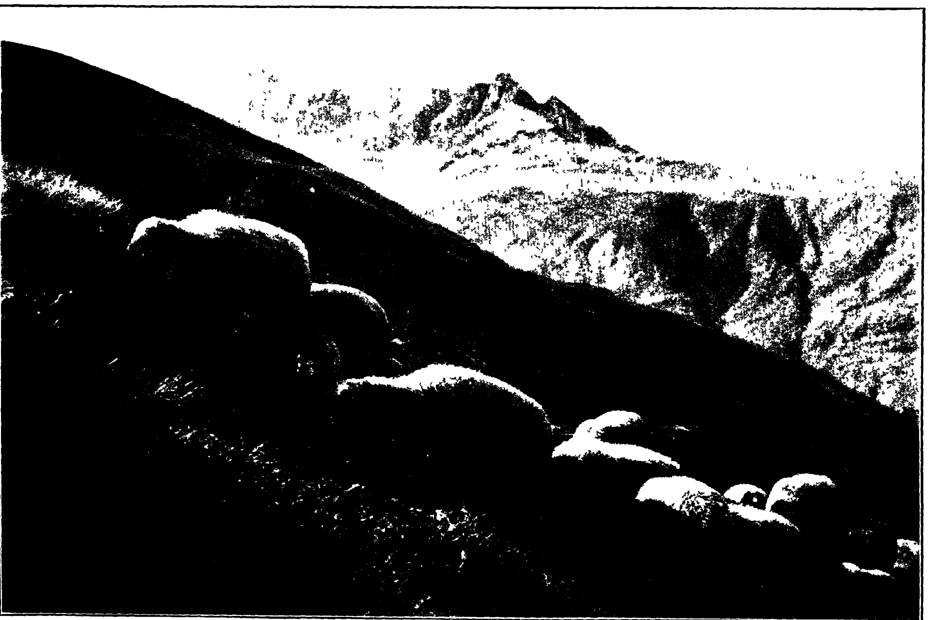
These come next in importance to backgrounds. Here again a second clothes-horse will prove useful. The material of the reflector is not of much consequence provided it is white. We may thus use a sheet or tablecloth or plain white paper. Indeed, a newspaper is better than nothing, although a large proportion of its surface has been put out of action by the printing ink. In order to see the effect of the reflector it is an admirable plan to enlist the services of a couple of patient friends, one as the sitter, the other as the background manipulator. The sitter should keep in the same position in the room, and the reflector moved this way and that, while the student keeps his head under the focussing cloth and watches the effect on the ground glass. But of course as each effect on the focussing screen is produced he should observe and store up in his mind the relative position of background, reflector, camera and window, so that at any future time this or that effect can be obtained. Two points should be observed: first that the reflector not only reflects the window light falling upon it on to the shadow side of the figure, but in nearly all cases throws some light on to the background or wall; also that the nearer the reflector is to the figure the more accentuated its effect, and that by increasing the distance between the reflector and sitter a more diffused, even effect is obtained. When working in a room with two windows care must be taken not to produce a cross-light effect. This may arise if one side of the figure be illuminated by the light coming through one window and the shadow side by light entering by the other window, and reflected on to the shadow side of the figure. The beginner is apt

to fly from one extreme of *no* reflector to the other of *too much* reflected light, and may be even tempted to use a mirror. This is a grave mistake. The reflector may desirably be as large as the background.

Of course, it goes almost without saying that in outdoor work we seldom, if ever, need a reflector, though at times a light wall, sail of vessel, etc., may give very charming effects of this nature. And it would be quite a mistake to say that in indoor work a reflector is always needed. It may well happen that the walls of the room are effectively reflecting and scattering the light. Or again we may with deliberate purpose desire to get strongly marked contrast effects of light and shade. But in any case the golden rule of art, " Ars est celare artem," prevails. If a reflector be used it must not be so ostentatiously employed as to attract notice to the means whereby the effect has been secured. The observant worker will soon see the difference obtained by using a large reflector at some little distance from the sitter and a smaller one near to him. The former is generally preferable.

Lighting.—This is the crux of the whole matter. Do not forget William Hunt's saying that picturesqueness is a matter of light and shde. The beginner nearly always places his sitter (when working in a room) as near the window as possible, with the result that half the face is in strong light, the other half in strong shadow. Exposing for the light and ignoring the shadow, he greatly under-exposes, and then, wrongly thinking that prolonging development will rectify what in truth it will tend to exaggerate, obtains a black and white effect. These three mistakes (harsh lighting, under-exposure, over-development) are the cause of quite nine out of ten early failures.

It is a safe working hypothesis that in nature there is nothing quite white and nothing quite black, and



MOUNTAIN PASTURES.
BY G. R. BALLANCE.

in art one may translate this by saying that in a picture little or nothing should be quite white or quite black. Pictorial effect depends upon two chief factors: (1) breadth in the arrangement of the masses of light and shade, and (2) gradation of shadows. If your shadow portions are fairly right in tone value the high-lights will frequently look after themselves. Applying all this to our portrait work in a room we must remember that the eye can take in a range of light and shade greater than our negative can record or our printing papers yield. Hence it is that the eye does not, at first, realise the strong light and shade effects of interior lighting, or at any rate the untrained photographic eye does not realise how much stronger the difference of light and shade will probably seem to be in the print than in nature.

The nearer the window the stronger the light, but as the shadow sides are not proportionally strengthened the nearer the window means the stronger the contrasts, unless proper care be taken about the size and position of the reflector.

Portraiture is no exception to the general rule of "expose for the shadows," therefore let the beginner guard against thinking that the nearer the window the shorter the exposure is a rule in this matter. Indeed, the opposite might more often be the case, on account of the contrast effects being likely to be greater than the negative or printing process can adequately render.

When the composition includes only a very small bit of strong dark then at times we may ignore this and adjust our exposure for the more important proportions of dark, but not darkest part.

It will be found advisable to give a somewhat fuller exposure for those arrangements of light and shade which give a picture chiefly shadow—for instance, in what are often called Rembrandt lightings.

DEVELOPMENT.

This calls only for a few words to the worker who is familiar with this subject in general. In portraiture we do not, as a rule, desire such a great range of contrast as in ordinary landscape. Our high-lights are not so bright, our shadows are not relatively so dark. Again, we do not usually desire so strong a light for portraiture as a sunlit landscape. Hence, in general we do not desire so long a range of densities—in other words, so much contrasts—in a portrait as in a landscape negative. Other things being the same, this means one of two things, either shorter time of development or more water in the developer, so that contrasts may not be the same. As a rough sort of guide to start with, one may say to the beginner in portraiture that if your landscape negatives take six minutes to develop, then your early portrait experiments should not be developed for more than four or four and a half minutes. Of course, experience will justify the worker modifying this to meet his own requirements.

In the not unlikely case that the reader has already discovered the "quite best" developer among the eighteen or twenty now on the market, we have no desire to disturb this conviction. If, however, he is seeking advice, a word may be said in favour of an unprejudiced trial being given to Metol, Rodinal, or Ortol. Seeing that the beginner's early failures will most probably be due to excess of contrast in the negative, we suggest metol because this is a member of that class of developers that bring out shadow detail quickly after the high-lights have made their appearance. If, then, the worker guards against prolonged development, he will not err on the side of excessive contrast, provided the exposure has been enough to impress shadow detail.

It will suffice if one formula be given as an example of

what the writer has found quite satisfactory in actual practice :—

Water 18 oz., soda sulphite 1 oz., soda carbonate 1 oz. When dissolved allow any sediment to settle, and decant or filter off the clear part ; add 1 drachm metol, and make up to total bulk 20 oz.

This single solution is used just as it now is, and will keep in working order a month, but it gets slower with age. A week is a desirable limit of keeping time if best results are desired.

The image of a correctly exposed negative appears in ten to fifteen seconds, according to temperature, plate, brightness of high-light, and so on. With most plates one should get a nice soft range of gradation in about twenty times the time of appearance. Thus, if the image first appears after twelve seconds' immersion in the developer, we may carry on development for twenty times twelve seconds, or four minutes. If this ratio is found to yield too little contrast, we can easily prolong the time of development for greater contrast.

With some plates it may be found necessary to add a little potassium bromide to the developer if fog is present in detrimental degree. The quantity of bromide for the foregoing developer is at the rate of half to one grain per ounce, or ten to twenty grains for the twenty ounces. But as the presence of bromide in the developer tends to hold back shadow detail in the early stages of development, its presence is not desirable unless some peculiarity in the particular plate demands it.

PORTRAIT *versus* LIKENESS

The tiro may hitherto have regarded these two terms as synonymous—as meaning " the same thing." And so they do to many photographers. This is just where good portrait painters find fault with average photographic portraiture. Nor is it to be wondered at that

the majority of professional photographers only aim at supplying likenesses when their patrons ask for nothing different.

Happily, however, there are a certain number of professional portraitists who are aiming at, and sometimes succeeding, in adding to the likeness that characteristic yet indescribable subtle something which makes it a portrait as well

If we took at random a score of portrait examples of the more advanced amateurs and a like number of ordinary professional works, we should probably find the latter showing better technique, but the former would show us better portraiture.

This point, therefore, should teach us to see that in a portrait we must aim at avoiding the air of self-consciousness in the sitter which accompanies the professional studio example. As some people have a special set of (theoretical) morals which they assume with their Sunday clothes, so others seem to have a special series of abnormal expressions and poses which they assume for the sake of photographic portraits, much in the same way as Sir Joshua's sitters seem to have spent their whole existence in saying "Plums, prunes, and prisms."

In a portrait we seek to find some intimation of the character of the person, something in addition to his outward form and shape. This may be portrayed in many different ways, independently or conjointly. For instance, the lolling pose of the indolent sitter, the alert wide-awake turn of the sitting or standing figure, the pose and poise of the head on the shoulders, the facial expression, the position and suggested action of the hands, the engagement of the whole body, the dress: these are some of the matters which properly engage the attention of the portraitist. And one or two very brief hints may serve to indicate some of the lines of study and observation.

Pose of Body.—A resting, leaning back, reclining pose does not harmonise with a wide-awake alert facial expression. Again, the pose must be in harmony with the surroundings. Thus, a reclining pose would not harmonise with a rocky background, nor should we usually look for a dramatic pose surrounded by flowers and foliage. A child holding a toy-boat would look "out-of-place" in the midst of a garden or with a woodland background.

Head.—The position and balance of the head on the shoulders are vastly important factors in conveying character. The reader, doubtless, will readily recall the memory of some one who habitually hangs his head forward or backwards, or has it a little bit on one side —this latter trick is often the result of astigmatic vision.

Hands.—Most people have some characteristic hand pose which they unconsciously assume when they are engaged in an interesting conversation or occupation. One man twiddles his watch-chain and another similarly patronises his moustaches, another dives his hands into the lowest depths of his pockets, while another seems to fear his coat is slipping off his person, and so on.

So many of our sitters say, "What am I to do with my hands?" The question shows how self-conscious they are. Perhaps the best answer is an artistic (poetic) evasion—*e.g.*, "We need not trouble about the hands at present. It is more important to think about the arrangement of the flowers on the table, etc.," and so turn the sitter's mind away from the self-conscious hands to some other matter

One or two points are worth bearing in mind For instance, the edge or side of a hand is more shapely and graceful than the back or palm. The fingers are preferable curved rather than straight A hand in strong light will look larger than in shadow. If the hand be at all con-

spicuous either by reason of its size, pose, or lighting it is not desirable to place it vertically under the head.

Photographers sometimes try to evade the subject of hand posing by arranging them out of sight. But this expedient, as often as not, carries its own condemnation by showing that it is a forced and not natural arrangement. The hands are often an important factor in the general success of the portrait, therefore to hide them is an obvious mistake. One should always observe the tone value of whatever comes behind the hands—clothes, table, etc.—so as to avoid excessive contrasts.

Facial expression.—For portraiture this should never be forced. Our aim is to produce a record of the person's character, and it is not unreasonable to say that our preference shall be given to his virtues rather than his vices. Most of us know some one who is usually a light-hearted and cheerful companionable fellow, but who also has a violent antipathy to some one thing or person which, like the proverbial red rag, puts our friend in a towering rage. To portray him in one of these quite abnormal fits would not be true portraiture, though it might be true at the moment. This, of course, is an exaggerated instance to point the moral, which can easily be applied in many other directions.

The one expression to avoid is the conscious "know-I-am-being-photographed" look which so many people almost involuntarily assume before the camera.

Posing.—There is a common saying to the effect that the best way to pose one's sitters is to leave them alone —*i.e.*, to engage them in some interesting conversation or occupation and to watch and wait without letting them even suspect that they are being watched, and then having observed some characteristic turn of the head, disposal of the hand, facial expression, to store this up and arrange for its continuance or revival.

The amateur has one great advantage over the professional, for the latter perforce has to "execute" so many sitters per day, many of whom he may not have seen before. But the amateur generally selects his "patients" from among his acquaintances, and can, previous to the operation, engage in half-an-hour's gossip, such as easily follows when portraits of mutual friends are being examined and criticised.

Orthochromatic Plates and Colour Screens are often ruled out of court for portraiture, on the not always sound assumption that they entail exposures impracticably long. For ordinary room portraiture they can generally only be employed under such favourable conditions as a good light, a fast plate, a steady sitter, and screens which do not necessitate exposures beyond two or three seconds. But for outdoor portraiture under favourable conditions their use by no means need be exceptional. Moreover the gain of more truthful rendering is quite worth the risk of occasional or slight movement rendered probable by the increased time of exposure.

The directions wherein lie some of their more noticeable advantages are better rendering of tone, value of drapery, colours and textures, a marked advantage also in the rendering of various complexions and hair colour. Moreover they considerably reduce the work of the retoucher, and also often convey a certain atmospheric quality—using this term in lieu of a better—to a portrait which is nearly always absent in portraiture with ordinary plates.

Of course for entirely satisfactory results one must use a plate sensitised for all colours with a suitable colour filter or screen. This often entails increasing normal exposure about 40 times, resulting in an exposure too long except under very favourable conditions. But by the use of a paler and, of course, not so truthful

colour filter results vastly better than those obtained without screens may be obtained. Thus a six or eight times yellow or pale orange screen may enable us to get a full exposure with an exposure of not more than a second.

Vignetting is not nearly so much in vogue as it was some ten or fifteen years ago, and this change is happily in the desirable direction. But it should not be too hastily concluded that its general avoidance should be followed by its absolute exclusion. Occasionally the vignetted portrait is entirely successful and satisfactory. In such cases we may generally observe the following conditions. The sitter is simply dressed—*i.e.*, absence of marked patterns or contrasts. The draperies are white or light. The background is fairly light, though not quite white, and is of the plain variety—*i.e.*, without pattern, though it may be somewhat graduated in light and shade. The pose is so arranged that the sitter is not looking at the camera. There is absence of very sharp focus in any part of the picture. The face is not very much darker or lighter than the background.

Relative Position of Camera and Sitter is a matter which does not usually receive the attention it deserves from the amateur. Very often he supports his camera on an ordinary tripod, and this usually brings the lens too high up above the seated figure. This looking-down-upon-the-sitter effect often gives a distorted and unpleasant view. We see too much of the top of his head, and his shoulders seem too high, which at times gives a suggestion of humpback. The nearer we are to our sitter the more marked is the evil effect of this too exalted view point. Moreover, if the floor of the room be seen, this elevated position of the lens gives an unpleasantly exaggerated perspective effect, and seems to suggest an uprising rather than a level floor.

Draperies often go a long way in the making or

marring of a portrait. The former is very noticeable in many of the masterpieces of painting, while the latter is the rule in photographic portraiture. With so many people there seems a lingering tendency to what gardeners used to call a "throw back"—*i.e.*, return to primitive and wild forms. Dressing for a photographic portrait so often means, if not returning to ancestral war-paint and feathers, at any rate putting on their newest and most striking and startling up-to-date latest fashion garments. If anything is calculated to induce a conscious expression either of vanity in woman or discomfort in man, surely it seems to be the putting on of new clothes.

The portrait student will do well to make careful notes of the tone value for light and shade effect of various colours and textures such as are usually worn, so that he may advise his sitters not only to eschew new clothes and put on those that fit by reason of being well worn and have had time to accommodate themselves to their wearer; but also may offer suggestions as to what to use and what to avoid.

Strong contrasts, such as white lace on black silk, are best left alone. Such marked differences are very likely to be "noisy" in the picture. Again, pronounced patterns, stripes, checks, etc., are dangerous, and best passed by. Fur is always useful, and often very helpful. Soft pliant clinging materials are more graceful in their folds than are stiff and hard things. Well-worn velvet often gives beautiful passages of light and shade.

If lace is worn it is better slightly tinted, and not quite white. The less jewellery visible the better for photography. Ladies may wear hats and bonnets and other head-gear, but it is seldom indeed that a man does not look better without than with his hat.

In arranging draperies the student should remember that their chief pictorial purpose is to give agreeable

masses of light and shade, to show graceful and harmonious lines and forms, to suggest the general disposition of the form of the person wearing it, and never to draw attention to the qualities of texture or colour. Hence it is that fur with its soft outline has always been esteemed as one of the most useful aids in portrait draperies.

Due harmony and fitness should be observed between the tone value of the chief draperies and background. A figure in dark draperies is seldom satisfactory with a very light ground.

The Placing of the Figure in the Picture space is far more important than the beginner might suppose. We can only mention one or two of the more important matters, and refer him to this subject as illustrated by the masterpieces in our public picture galleries. The figure must not be so large or have so little free space round him that a slight movement would bring him in contact with the frame. The young photographer, in his desire to get a large head and shoulders on a quarter-plate, frequently makes the mistake of overcrowding his picture space. If the head comes too near the top of the picture a false idea of tallness may be conveyed. Conversely, if there be too much space above the head the impression may be equally false in conveying the notion of a short and stumpy figure. If there be a marked excess of space in front of the figure then this may easily give the notion of a figure backing out of the picture; and similarly, if there be too much side space behind the figure one may imagine the figure to be passing out of the picture on the face side.

Trimming the Print is a matter calling for great care on the part of the portraitist. In this matter one may often glean useful hints from the study of engravings and etchings by artists of eminence. The use of a large plate thus gives us choice as to how much shall be left

here or there, while a small plate often gives an over-crowded effect, because we have not quite satisfactorily placed the figure, or the figure has moved slightly after the ground glass picture had been composed.

Accessories, Furniture, Etc.—The budding tiro may be pardoned if, when starting photographic portraiture, he is prompted to imitate the style of some brother professional, and introduce the time-honoured table with vase of flowers. As we are not dealing with studio portraiture this style does not concern us just now. But for home portraiture anything so formal as the style just suggested would be quite out of harmony

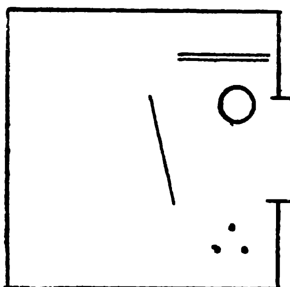


FIG. 1.

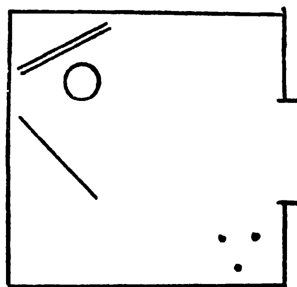


FIG. 2.

with the chief idea. Ordinary people in their own homes do not as a rule put themselves with their backs to a wall and give up their time to staring into vacancy. Nor do they find much comfort or convenience from the too close proximity of small top-heavy tables over-loaded with vases, picture-frames and other drawing-room nick-nacks. If you elect to use a table have a practical one, and let the articles on it be real, practical and appropriate.

A man may have a writing-pad, or book and paper-knife, a pair of gloves, etc. A woman may have her work-basket, fancy work, knitting, etc., or some other outward and visible sign of her laudable occupations.

The " engagement " or occupation of the figure must

always be quite real. To put a violin into the hands of one who does not play this instrument is at once to betray your ignorance of your craft, for almost certainly will he hold it in such a way as to show that he is not a violinist. But if he be a fiddler he will probably have his most characteristic facial expression when handling his "little box wi' strings," but also his hands, which without the instrument seem ungainly, will at once seem natural and graceful directly he begins to handle his favourite companion.

Some Schemes of Lighting are shown in the accompanying diagrams (Figs. 1-6). In each instance, we suppose the home studio to be a square room with a window in

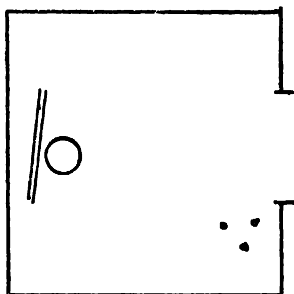


FIG. 3.

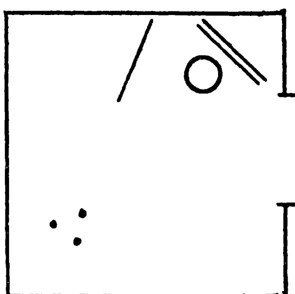


FIG. 4.

the centre of one of the side walls. This window opening is on our right in the several ground plan arrangements shown. In each case the sitter is represented by a small circle and the position of the camera by three small dots, which may be taken as suggesting the three points of a tripod. The double line behind the sitter is the background and the single line the reflector.

In Fig. 1 we show the beginner's usual plan of placing the figure close up to the window. Background and reflector are usually unknown in the first few efforts, but we show their position most likely to give the best effect in this undesirable position. In such a case as this the exposure should be generous without being

excessive, and a dilute developer will give a softened rendering of what probably will at best be a somewhat harsh black and white scheme of lighting.

In Figs. 2 and 3 we keep the camera in the same position as in Fig. 1, but move the other factors in the case.

Fig. 2 shows us a more promising arrangement. Here we have our sitter further from the light, so that there will be less contrast between the light and shadow sides. The exposure in such a position will not need to be any longer than, if as long as, in Fig. 1, although our sitter is further away from the window. By varying the angle and position of the reflector we can in such a

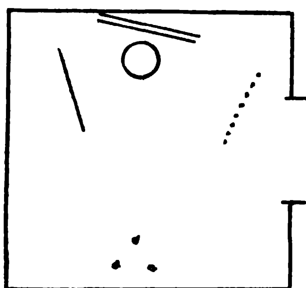


FIG. 5.

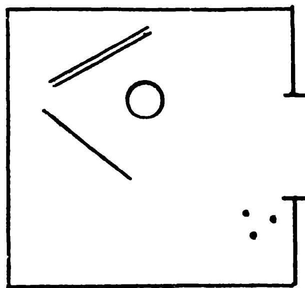


FIG. 6.

position get a considerable range of differences between the light and shadow sides.

Fig. 3 is inserted as a warning, for in such a position as this we should have a practical absence of shadows and consequent flatness and loss of pictorial interest.

Fig. 4 shows us a position which is capable of yielding a considerable measure of pictorial effect. By this general style of arrangement we can get various shades of the so-called Rembrandt lighting—or what a friend calls the "new moon" style of lighting—*i.e.*, a more or less narrow marginal light, while the greater part is in subdued tones. This position calls for generous exposure and cautious development, with watchfulness against

carrying development far enough to blacken the shadow details in the print before the high-lights are duly subdued and modelling suggested

In a case of this kind the half of the window next the sitter may advantageously be draped with lace curtains. These help to subdue and soften the light, and so minimise the vigour of contrast. Care must also be taken to shield the lens from the direct light of the window falling upon it. If this be not done the negative is very likely to show general fog, due to light scattered by the surface of the lens.

In Fig. 5 we have a modification of Fig. 1, but being further from the window our contrasts will be less marked. If we arrange a screen of very thin muslin or waxed tissue paper in the position shown by the dotted line we can get vastly better modelling and very soft round effects. But the muslin screen means a certain increase of exposure.

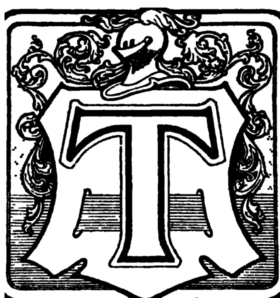
In Fig. 6 we have a position which is capable of giving a good variety of modelling according to the size and position of the reflector. This also enables us to use our lenses of longer focal length.

It may be noted also that the same background would appear lighter in such positions as Fig. 3 and Fig. 6, where it gets direct light from the window, than it would in such positions as in Fig. 4 and Fig. 5. Of course the reflector will throw some light upon it, even in such a position as in Fig. 4.

Conclusion.—The would-be portraitist must not be content to take anything herein said with too great confidence. Indeed, it is wiser for him to suspend his judgment and regard the foregoing notes as suggestions for experiment. On the other hand, let him beware of drawing conclusions too harshly from a few such experimental trials.

F. C. Lambert, M.A.

P.O.P.



HE above heading has no reference to temperance drinks, but is the universal abbreviation used in describing a particular method of photographic printing. I suppose there is scarcely any need to explain that the strenuous life of the late nineteenth and early twentieth-century periods has compelled photographers (and who does *not* photograph nowadays ?) to adopt this as a convenient abbreviation to the proper name, *viz*,. Printing-out-Papers. True, I know one amateur who probably uses this method far more than any other, and who always speaks of it with a loving intonation in his voice as if the term carried some occult meaning with it. He invariably says " pop-papers," so I presume he does not realise the exact meaning. To many minds the term " P.O.P." has somehow or other received a peculiar limitation. When they ask for P.O.P. they mean gelatino-chloride of silver emulsion paper, and no other. This limitation is becoming almost universal now, irrespective of the fact that albumino-chloride and collodio-chloride are also printing-out-papers. So for the purposes of this article I propose to stick to the P.O.P.-ular idea rather than a scientifically correct rendering, and shall therefore deal with the well-known gelatine emulsion papers only.

It has been said times without number that the advent of the dry-plate inaugurated the reign of the

ubiquitous amateur in photography. Doubtless! But I venture to add to that the statement that the dry plate alone could never have accomplished it, and that P.O.P. had as large an influence in making easy and popularising photography as ever the dry plate had. And this is queer, because P.O.P. is not the easiest process to work after all is said and done. There are so many ways of spoiling a batch of prints that one often wonders why the beginner does not tackle bromide paper or gaslight paper first. The reason undoubtedly is that one can *see* what one is doing with P.O.P., and that does away with the feeling of blind guess-work that attaches to one's first attempts with development papers. However, P.O.P., with its visible image, certainly holds the field among beginners, and the consideration of a few pointers in producing good results with certainty should be acceptable.

The instruction sheets issued by the manufacturers of Barnet P.O.P. say :—

Care should be taken—(1) to keep the prints moving in the different solutions; (2) to keep separate dishes for working P.O.P., and never use them for any other purpose; (3) to use only the best chemicals; and (4) to be scrupulously clean in all operations. To these points may be added one or two others, equally important—*e.g.*, to keep the paper in good condition before, during, and after printing, previous to toning; to keep all solutions at an equable temperature; and to carry rules (2) and (4) to a greater refinement by keeping each dish for its own particular use (washing, toning, or fixing); and by regarding the necessity for chemical cleanliness to apply to the manipulator's hands and fingers just as much as it does to dishes and measures.

Taking these points seriatim, the need for constant movement of the prints is a very real need, because unless the various solutions have free and equal access

to all parts of the prints—front and back—at the same time unequal chemical action is inevitable, and hence patchy, unequally-toned prints, or else imperfectly fixed or washed prints, which will ultimately discolour in patches. The method of moving the prints is worth mentioning. Many workers seem to think that if the dish is kept rocking, as in developing a plate, it is sufficient. Far from it. Such a plan might answer for single prints, but not for batches. The correct way is to feed the prints separately into the bath, each one face downwards. This is done with the right hand whilst keeping the mass of prints on the move with the left hand. Thus each hand is kept in a different solutions and never touches the other until the whole batch is transferred. Both hands can then be used in the one bath, and the whole batch kept constantly on the move by inserting the fingers under the prints and continually bringing the bottom ones up to the top. This can be done singly in the case of small batches of a dozen or fifteen prints; but larger batches need quicker attention, and the bottom ones should be withdrawn in lots of three or four at a time with the right hand. They are then quickly separated with the left hand, whilst the right is fishing for another lot. The advisability of keeping each hand in its own dish is most plainly seen when hypo is one of the solutions in use; but the method still holds good in the case of other solutions, which do not show the evil effects of contamination so unmistakably. Besides which it is a good habit to cultivate until it becomes automatic.

The second point should not need elaboration; it is self-evident. Dishes can now be obtained which are legibly marked "washing," "toning" and "fixing," and each dish should be religiously kept for its own particular purpose.

The third point should also be axiomatic. It applies

to all chemicals used, but most emphatically to the gold, Cheap gold cannot be good, because gold is gold the world over, and any attempt at cutting the already phenomenally low price of gold chloride can only result in a diminution of the quantity of the precious metal present in the salt—to the detriment of results. I suggest that for the occasional worker Burroughs and Wellcome's tabloid toning baths are probably the neatest and best way of compounding the baths, and the purity of the chemicals is guaranteed by the firm putting them up.

Allied to this point is the use of hypo for more than one batch of prints. This is a most heinous offence for a silver printer to commit. There can be no excuse either. Hypo at 2d. per lb. is "cheap enough to eat," and whilst two pennyworth of hypo will make over half a gallon of fixing bath it is false economy to attempt a second use of it, although it may apparently work all right.

Clean dishes and measures are easily attained. A small stiff brush and a little Monkey Brand soap, *plus* elbow-grease, will do the trick. But I have seen printers who would spend a quarter of an hour scrubbing their dishes out, and who yet would have the impudence (I can call it nothing else) to eat apples or oranges whilst attending to their printing frames. Naturally, the result was red patches (where the fingers had touched the paper), which refused to tone, and the poor paper manufacturer was blamed because the printer was "quite sure his dishes were clean." Another way in which one may unconsciously sin. Many persons are liable to an imperceptible perspiration in the hands and finger-tips of which they are unaware. To this exudation P.O.P. is extremely sensitive, and the effect is much the same as that caused by greasy fingers. A simple remedy is to wash the hands in borax and water before handling P.O.P.

CARE OF THE PAPER.

Care of the paper is another point that is well worth attention, and all Barnet P.O.P. is sent out carefully packed, first in white paper, then in waterproof paper, and finally in a non-actinic envelope. When a packet is opened and a sheet or two removed for immediate use, the remainder should be wrapped again in its original casings, and the packet kept between the leaves of a fairly heavy book. Prints made and awaiting toning should be treated in exactly the same manner and not left lying loose in a drawer. Metal boxes for storing papers and prints are somewhat dangerous, but if the P.O.P. is kept wrapped in its original damp-proof-paper packing no harm should arise. In the printing frame also some precaution should be taken to prevent damp getting to the paper, or it will cause unequal expansion and cockled paper. Printing frames which have not been in use for a day or two pick up a lot of dirt and moisture on the cloth backs. The best preventives of trouble arising from this cause are rubber sheeting as used in platinotype printing, or two or three sheets of celluloid. These also help to ensure perfect contact between negative and paper at all points.

TEMPERATURE.

The temperature of photographic solutions is a subject which is very much neglected in this country. We hear and read of workers in other climates who have to wait until the cool of the evening before commencing chemical operations, and even then they use cool well-water or adopt the method of adding ice to their solutions.

The reader usually feels thankful that he does not need to resort to such practices in this country, and then promptly forgets all about it. In reality there is just as much need here in England to study temperature as anywhere else, although, judging by the recent

samples of summer weather that we have experienced, there is very little necessity for ice-water. But in the reverse direction a great deal may be done. Almost every kind of chemical action may be accelerated by heat, and whether we are developing. toning, fixing, or washing, this rule holds good. Plate development is outside the province of this article, but toning is a big part of our subject. If the toning bath is made up from ordinary tap-water drawn from the mains during any but the hottest months of the year, difficulty will be experienced in getting good tones with ease and regularity. On the other hand, excessive heat has its dangers as well.

In the case of P.O.P. the most evident danger is that of melting or even softening the gelatine coating of the paper. A simple plan is to purchase a small thermometer, preferably made entirely of glass (mine cost 1s. 6d.), and to accept as a general rule the dictum that no bath should be below 60°F. or above 70°F.

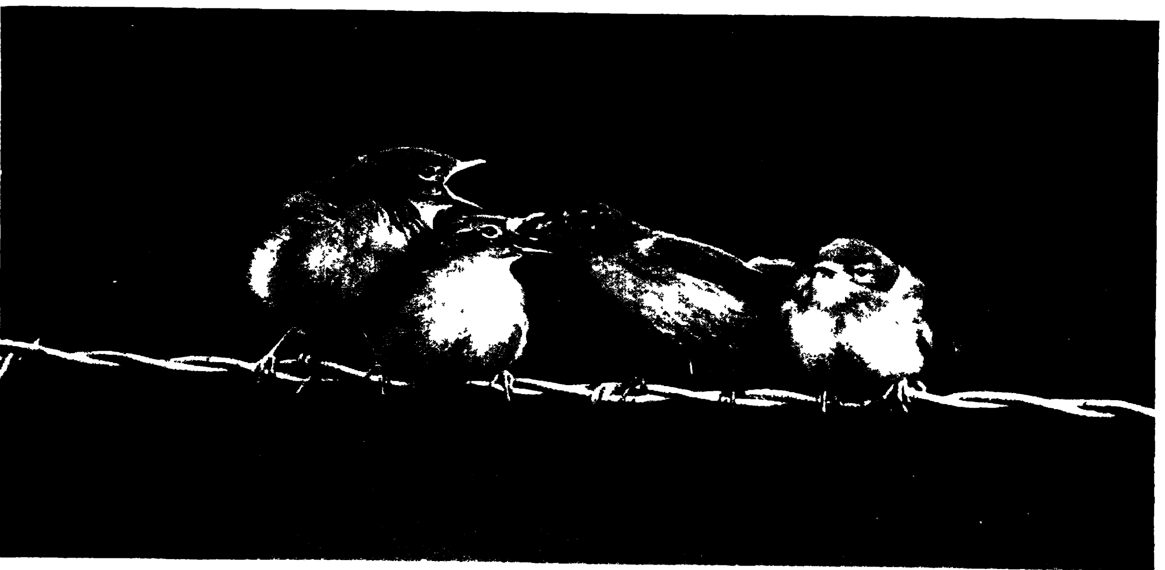
In the case of the toning bath this heat may be attained first of all by making part of the solution with warm water, and the prescribed temperature can be maintained by having an outer and larger dish containing hot or warm water. In this larger dish the actual toning dish may lie or even float, and the contents of the inner dish can be kept at any required heat by additions of hot or cold water to the outer dish; and this without dilution of the toning or other solution. To a P.O.P. worker struggling with a batch of prints in a cold dark room or domestic kitchen or bath-room, the adoption of the above method will probably be a revelation. At 65°F. toning becomes a pleasant and expeditious operation, and, still more, the tones obtained in a bath at this temperature are, to my mind, finer in quality than those reached by slower or quicker baths at lower or higher temperatures.

With the fixing bath the effect is not so apparent to the naked eye, but a little careful reasoning will prove that the same rules hold good. The fixation of a paper print is not a thing that can be readily judged by the eye at any time. Some old-fashioned printers with twenty-five to forty years' constant every-day experience will tell you that they can *see* when a print is fixed. Perhaps they can. But never a one has been able to tell me exactly what the appearance of a properly fixed print should be, and I much prefer to work by a more scientific rule, which allows sufficient time for the complex chemical operation of fixation to be complete. Suppose, for a moment, that a quarter of an hour is allowed for this purpose, and that the prints are kept moving during the whole time in a solution at about 60° F. (either natural or induced by other means as suggested), there is every probability, nay more, a certainty that such prints are thoroughly fixed. Now take the opposite and, unfortunately, more usual course of paying no regard to temperature. A number of prints have been toned and await the fixing bath. The requisite quantity of hypo crystals are weighed out (sometimes guessed) and water added from the tap. The immediate effect is a lowering of the temperature 15° or 20°, sometimes even to freezing-point, and the only natural inference is that the necessary chemical action cannot take place in the same time as when normal temperature is maintained. In this connection a word of warning may be given. On no account should boiling water be added to hypo crystals. If this is done a very peculiar effect may be observed. Some of the crystals appear to be slightly melted by the heat and will be found to be sticking tightly to the bottom of the dish, and if not removed will cause trouble afterwards. A good plan is to put the hypo crystals into about half

the necessary bulk of water, which should have a temperature about 80° F. Solution is thus quickly obtained, and the total quantity is then made up with hot or cold water as needed until the whole is at normal heat, and finally this temperature is kept up by means of the outer dish. The final washing of prints will also proceed more effectively if the water is not too cold, and I shall show later that this is not a difficult matter to manage.

VARIETIES OF P.O.P.

Having cleared up some of these points, we will now commence again at the beginning and see how P.O.P. should be worked in order to produce pleasing and lasting results. First of all, the choice of a paper. The manufacture of P.O.P. has nowadays been reduced to a fine art, and Barnet papers give us a good selection to choose from—thick and thin, glossy and matt, tinted and white. The thick paper, which is really cardboard stiff enough in small sizes for all ordinary purposes without mounting, may be utilised in a variety of ways. It is sent out cut to the regulation size, with orthodox lettering on the reverse side for post-card purposes; also in ordinary photographic sizes, from which by suitably masking portions of the card, very pretty Christmas and Greeting Cards can be made up. Many other means of utilising this sensitised card will suggest themselves to the inventive mind; for example, Menu Cards, "At Home" Invitations, Wedding Cards, commercial name and address cards, etc. The treatment in no way differs from that necessary for ordinary P.O.P. The matt paper will naturally appeal to the more artistic workers, and by the use of various toning baths a large variety of colours—brown, red, and purple—may be obtained. But, after all, it is the glossy paper that is more generally used. *This* is what most folks mean



WILLOW WRENS
By CHARLES KIRK

Taken on a Barnet Ortho Plate

when they say " P.O.P.," and it cannot be gainsaid that for small work and any subject that requires the fullest detail present in the negative to be shown in the print there is no method that will give finer results. For tint of paper I have a decided bias in favour of the mauve, because white paper is apt to turn a bit yellow with age, whereas the mauve tint seems to fade to a white. For the pink I cannot say a good word at all, but it is a question of taste, and the tint is there to hand if desired.

For small sizes—C.D.V., ¼-plate, 5×4 and ½-plate or cabinet—the paper is best purchased in packets of cut sizes. For larger sizes, or for workers who make all sorts of sizes the sheets are best. When cutting up sheets of P.O.P. (they always have a strong curl and need a good grip), it is certainly advisable to wear a pair of white cotton gloves, also to remember that metal is not a good thing for sensitive paper. Therefore, the sheets should be doubled to the sizes wanted and a bone paper-knife used for actually cutting up.

PRINTING.

All is now ready for the actual printing. Is it necessary to say how that is done ? The paper and negative are brought into contact in the usual printing frame, and then exposed to light until the desired depth is reached. This can be judged by occasionally opening the frame and looking at the progress of printing ; but it must be borne in mind that if too frequent, or if made in a bright light, these glimpses will result in a degradation of the whites of the photograph. Direct sunlight should never be used for P.O.P. printing : at least, " hardly ever." An exceedingly dense negative may demand it sometimes, but it should be avoided if possible. Use the best shade light obtainable, or, failing that, sunlight may be resorted to by pasting tissue-paper over the front of the frame to diffuse the

light. The electric arc can also be used in this way, and will be found quicker than winter daylight.

A little thought and coddling should be devoted to abnormally thin negatives. If printed carefully in a quiet light and lightly toned to a chestnut-brown colour comparatively good results may be got from a negative that will only yield flat, slatey-coloured prints when printed in a strong light and toned to the purple stage. Good purples and purple-blacks can only be obtained from negatives which have a good range of contrast: that is to say, negatives which have been well exposed and development carried rather far.

The depth of printing must be regulated by the bath in which the prints are intended to be toned. Sulphocyanide and tungstate baths cause least loss of depth during toning, whilst phosphate and bicarbonate baths cause the greatest amount of reduction, with the exception of platinum baths, which need still deeper printing. These differences are, however, not so great as one would suppose, because whilst a print intended for platinum toning should be fairly strong and be decidedly tinted over in the high-lights, even a print which is to undergo treatment in the sulphocyanide bath needs to have *some* detail showing in the lights, and to be darker all over than a finished print should be. Experience will soon show the correct printing depth.

Occasionally one's judgment of the depth of printing may be upset by the colour of the image during printing. Sometimes it is quite a blue colour, at other times a bright red. I believe this to be accounted for by the presence of moisture in the paper, because a freshly-opened packet will print blue, whilst one that has been opened and left for any length of time in a damp atmosphere gives the red-coloured prints. I find that a blue print loses more in the subsequent toning and fixing

than a red one does. Consequently a blue print is carried a little further in printing. In the extreme case of an atmosphere that is both damp and warm, when the paper is quite limp I find that I get much more contrasty prints than with fresh brittle paper. It would hardly be safe to make experiments with damp silver paper on valuable negatives, otherwise there might be here the germ of a method for getting bright snappy prints from flat negatives.

VIGNETTING.

Many a negative can be made to give more pleasing results by vignetting, especially in portraiture. Various

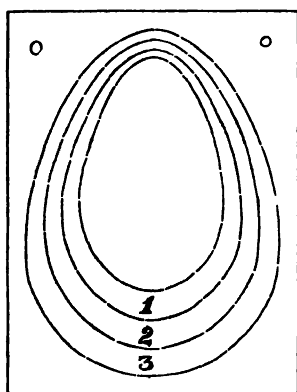


Fig 1

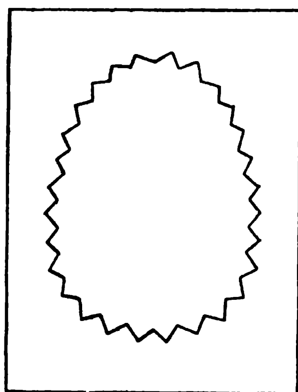


Fig. 2

devices are on the market for obtaining the soft delicate gradations that form the charm of a good vignette. Of these ready-made appliances I can, from experience, recommend the "Golden Vignetter." I have also home-made articles which give results that are hard to beat. These are made with successive layers of tissue paper, as in Fig. 1. O is opaque paper or cardboard, and 1, 2, and 3 represent one, two, and three thicknesses of tissue paper, each with a larger opening than the preceding, whilst the centre is quite open, but is covered by a

diffuser over all when in use. Even a simple hole cut in a piece of cardboard, and the edges serrated as in Fig. 2, will give very good results if kept at a sufficient distance from the negative. Herein lies the real secret of vignetting: the distance from the vignetter to the glass side of the negative is not sufficient when the appliance is just fastened to the front of the printing frame. For soft vignettes it should be at least one inch away, and the front of the frame must be built up to that height in order to hold it at that distance. For large sizes, such as ½ plate and upwards, this distance should be considerably increased. It is usual to recommend that vignette prints be made in a good shade light, with constant turning of the frame, in order that the light may creep under the vignetter in all directions equally. Personally, I find it much easier to cover the whole of the vignetter with a sheet of tissue paper, and print in direct sunlight—when I can get it. Of course, when Old Sol absents himself for days at a time, as is his present habit, I have to adopt the first method, but I must admit that I get softer vignettes in direct sunlight with the tissue-paper diffuser than I do in a shade light with or without it.

TONING.

Having made our prints, we proceed to tone them. A word or two as to how many should be manipulated at a time. Whilst I do not advocate single prints or even couples, preferring fairly large batches, there is a limit in this direction. I *have* toned as many as 450 cabinets and C.D.V.s mixed in one batch in a large dish under the pressure of business circumstances, but I cannot recommend the practice, nor should I like to be called upon to swear that the whole of that 450 were alike in colour, or even that each print was free from patchiness. Fifty cabinets, seventy or eighty quarter-

plates, or about a hundred C.D.V.'s., make a very comfortable lot for an experienced hand, whilst a beginner will find twenty prints at a time quite as much as he can manage.

Before toning P.O.P. prints it is necessary to get rid of certain free silver and other soluble salts that are in the paper. It is usual to recommend that the prints be well washed for this purpose. Herein I differ from the usual printed instructions issued with P.O.P.s. If the washing method is adopted the presence of free nitrate of silver is instantly detected by the milkiness caused in the wash water, and unless the first washing is very expeditiously performed and a fresh water bath substituted, this free silver has a great tendency to make the whites of the photograph turn yellow. Again, the water that we use is almost invariably conveyed through metal pipes—sometimes made of iron; in fact, I believe all the larger mains are iron. Water coming through such pipes nearly always carries particles of the metal with it in suspension, and woe betide a print in the first wash water that encounters any of these floating particles! Black spots invariably result, and very often they take the shape of comets with long tails, which are particularly annoying. Now these troubles can be avoided if, instead of trying to wash out the soluble salts, we proceed to convert them into insoluble chloride of silver—that is to say, insoluble in water, but soluble in hypo, and therefore discharged by and by in the fixing bath. For this purpose a bath is prepared composed of ordinary table salt, one ounce dissolved in a pint of water, using larger proportionate quantities for larger batches of prints. With a paper containing a large proportion of free acid as well as silver, it may be advisable to add to this salt bath a crystal or two of washing soda, but I have not found it necessary when using Barnet P.O.P.

In the salt bath there is no milkiness, because the free silver is immediately converted into a chloride, and in addition to that all prints are brought to one uniform red colour, which enables the progress of toning to be very easily judged. Care should be taken when inserting the dry prints into this bath that no bubbles of air adhere to either front or back of the prints, otherwise the conversion into chloride will be unequal, and patches of a different colour will show after toning. These patches will be found to correspond with any bubbles that have not been wiped away in the salt bath. If a batch of twenty prints are inserted singly, and each one freed from bubbles as immersed, the first (or bottom print) will be ready to come out by the time the last one is put in.

The extraneous salt now needs washing away, but as table salt is so easily soluble in water this need not be a long job. At the same time it should be carefully performed, otherwise the salt may upset the toning bath, retarding its action, or even stopping it entirely for a while. If two dishes are employed and the prints passed singly from one into clean water in the other, draining each print between the dishes until all are in the second dish, it will readily be understood that a very large proportion of the salt is left behind in dish No. 1, probably nine-tenths of it. Throw the contents of dish No. 1 away, replace with clean water, pass the prints back again in the same manner, and a large proportion of the small quantity of salt carried into dish No. 2 must again be left behind. If the process be repeated four or five times—say for five minutes—there will be not much salt left in the prints—at all events, not enough to affect the toning bath.

Some toning baths should be made up at the time of using, whilst others are improved by making up an

hour or so in advance. Sulphocyanide baths are ready for use immediately the red colouration (which shows on first mixing) has disappeared. This is usually but a minute or two, and, on the other hand, the bath seems to work just as well if prepared some hours in advance. Formate, bicarbonate, and borax baths should only be mixed immediately before use, while phosphate and tungstate baths are better for keeping about an hour before use. An acetate bath is an extreme case, and is not in full ripe working order until a week old. Platinum baths are best directly they are mixed. Sulphocyanide has by some means or other become the standard bath, although it does not strike me as an ideal toning compound. Yet it is hard to name a better. Probably if the formate bath was as much studied and experimented with it would prove a better toning agent; but sulphocyanide is always given a first place on instruction sheets, and is almost invariably the one used by beginners. If the bath is made up from weighed-out chemicals, great care should be taken to ensure absolute cleanliness in the bottles in which stock solutions are kept, especially gold. A bottle intended for storing gold should be washed out with ammonia and water or hot strong soda water, and after rinsing should be again washed with dilute hydrochloric acid, followed by washing in plain water. As gold solutions are somewhat liable to the action of light, it is a good plan to paste brown paper around the outside of the bottle. A deep amber-coloured glass bottle will have the same effect, but blue glass, such as pyro bottles are made of, has practically no protective action.

With all gold toning baths the rule is that the gold solution shall be added to the other constituents last of all. If this is neglected with the sulphocyanide bath, you may possibly realise that the rule is dictated by a

real need, for under such circumstances it is very likely that the red colouration first formed will refuse to disperse, and then the only possible procedure is to throw the stuff away (which is wasteful) and make up fresh. The peculiarity is that this does not always happen. The bath will sometimes clear, but more frequently not. If sulphite is used as a constituent of the bath, it should be freshly mixed. Old solutions of sulphite are useless for this purpose. It is a debatable point whether the presence of sulphite is an advantage or not. I cannot myself say that I see any great gain in it, but many workers find a decreased tendency towards double tones when using it. I must admit it has not the slightest disadvantage attached to its use, so probably it is wisest to include it. Don't overstep the mark, however: an excess of sulphite will stop toning action almost entirely.

Sulphocyanide (among other objections) has an unpleasant tendency towards softening the gelatine of the paper, and very often leads to frayed edges. These are extremely annoying when prints have been trimmed before toning. Some makers recommend an alum bath before toning, in order to counteract this. I do not like the idea at all, and find it a frequent cause of unequal toning. A weak formaline bath is far preferable, because it has no detrimental action on toning. In fact, I personally add the formaline to the toning bath itself, using about three drops of formaline to every ounce of bath. But as a matter of fact the correct way to prevent frayed edges is to handle prints carefully, never touching the edges at all—never really taking *hold* of a print at any time, but allowing it to lie on the fingers or on the palm of the hand.

When working a sulphocyanide bath it is needful that all prints intended to be toned in the bath should be

inserted in very rapid succession, or else dropped in in a pile and very quickly separated. If one or two prints are put in and allowed to get a fair start before introducing others (which would be a very comfortable way of working if practicable), the first few prints seem to attract all the gold to themselves, and the later prints will suffer from pink half-tones, double tones, and other signs of an exhausted gold bath. The only practical way of working seems to be about as follows : Sufficient bath is prepared for the batch of prints. This batch will vary in size with the skill of the worker. Twenty is enough for a beginner and fifty a comfortable number for one more advanced. The bulk of the bath must be adjusted with the idea of having sufficient solution for the prints to be separated at all times by a layer of solution. They must *not* lie close together. This need not entail the use of more gold. Within reasonable limits dilution of the bath will only increase the length of time needed to reach a given colour stage. A very safe strength is one grain of gold (with proportionate amounts of other salts) to fifteen or twenty ounces of water, or two doses of " tabloids " in the same quantity of water. This quantity of bath will point to the use of a largish dish for toning, and it is a very good practice. No toning dish should be smaller than 10×8, however small the prints may be. Anything smaller than this does not allow sufficient room for the constant movement and changing position of the prints. Having made up the bath, the prints are lifted out of the wash-water in one loose pile. They should not be drained at all, or else they will begin to lie closely together, and toning will start from the edge instead of being equal all over. The whole pile is dropped into the toning bath and quickly swirled around with the left hand first one way and then the other (face down, of course). Meanwhile,

the right hand is constantly bringing small lots up from the bottom of the pile to be separated by the left hand. After a few minutes of quick manipulation in this way, one can take it a little easier, and bring the prints up singly, quickly examining each one for change in colour. As the desired colour (on the surface) is reached, the prints are thrown into a dish of running water to await fixing.

All toning operations should be conducted by gaslight. If daylight is used, it must be very dim for fear of fogging the prints, and then it is very difficult to judge changes of colour. I find much greater certainty in judging colour by gaslight.

The phosphate bath is a very good one, and, although not suitable for every make of P.O.P., will be found admirable for Barnet papers. It is an extremely quick-acting bath and the prints need careful watching and quick attention. It is not so liable to give double tones as sulphocyanide. The tabloid phosphate preparations give a bath identical in composition to that recommended with Barnet papers, if the quantity of water mentioned in the tabloid instructions is doubled. This is a more convenient strength in use, as the stronger bath is much too quick-acting for more than three or four prints at a time. The method of manipulating the prints is the same with this and other baths as with the sulphocyanide, with one possible exception. Mr. H. W. Bennett, when lecturing before the R.P.S. recently, pointed out that if the phosphate or formate baths are made up with distilled water in place of ordinary tap water, there would cease to be any necessity for all prints to go into the toning bath at one time, and they can be inserted one or two at a time. No doubt he is correct, but I always forget to try it because I am so used to the other way, as with sulphocyanide, that I do it from force of habit.

The formate bath is a great favourite with those who have had any long experience with it. The little peculiarities of different toning compounds do not show themselves at first. Like other good things, a toning bath "wants knowing" to fully appreciate its good qualities. One decided advantage of formate over sulphocyanide is the effect on the gelatine of the emulsion. So far from softening it at all, there is even a tendency to harden it, and prints can be handled in a much less respectful manner than in a sulphocyanide bath. A good formula is:—

Soda formate	15 grains
Soda carbonate	2 „
Gold chloride	1 grain
Water	20 to 40 ounces

according to speed desired. Soda formate is not an easy salt to obtain, but is readily procurable in tabloid form. Two tabloids each of formate compound and gold chloride, dissolved in 20 to 40 ounces of water will give a bath practically the same as the above. At full strength it is extremely quick-acting, almost too quick in fact, and the weaker bath will be found far more comfortable to use. Mr. Bennett's remarks *re* distilled water seem to have special application to this bath.

Gold chloride in combination with soda bicarbonate, soda tungstate, borax, and even washing soda, have their advocates, but there would not seem to be any special advantages over those combinations already mentioned. Soda acetate appears to be somewhat unsuitable for gelatine P.O.P. unless used together with sulphocyanide, and in that case one might as well use the plain sulphocyanide bath.

For matt papers platinum toning will yield an excellent scale of pure brown tones without any suggestion of purple. In this bath prints do not assume the colour they will eventually dry. They tone through stages of

claret colour to a violet purple, and a little experience is needed to know exactly when to stop toning. A rich claret colour on leaving the toning bath will dry up a good sepia, whilst if toning is pushed to the violet stage a very rich dark brown results.

Prints intended for platinum toning should, as already indicated, be very strongly printed, as considerable reduction occurs. As they leave the platinum bath the prints should be placed directly into an alkaline bath for a quarter of an hour before fixing. This alkaline solution is conveniently made up by dissolving a tablespoonful of washing soda in a pint of water. Formula for platinum bath :—

Citric acid	20 grains
Water	10 ounces
Table salt	20 grains
Potassium chloroplatinite.. ..	2 ,,

or tabloids according to directions.

SELF-TONING PAPERS.

A brand of P.O.P.'s which are now coming into great favour are the so-called self-toning papers. In these papers the necessary amount of gold is apparently incorporated in the emulsion itself, and toning is effected by simple soaking in a solution that will reduce the gold to the desired colour. For the purple tone that seems to be the desire of all beginners the alum and sulphocyanide formula recommended by the makers is certainly the best, whilst for distinctly warm tones I have found the salt bath as already recommended for ordinary P.O.P. an excellent one. Self-toning papers should not have preliminary washing whichever bath is used. They are inserted dry (with all due precautions as regards bubbles), and after about five minutes' immersion, during which they are kept moving as in a toning bath, they should receive a good washing in the manner before indicated, when they are ready for fixing. By the use of this class

of paper at least one bath is dispensed with, and there is a delightful certainty with which a large batch of prints can be brought to the same colour without a suspicion of double tones or even of unequal toning.

FIXING BATH.

The fixing bath of necessity follows all toning operations. In this the desired action is to dissolve away all sensitive silver salts, and leave only those that have been reduced by the action of light and coloured by the toning bath. It is commonly supposed that the silver salts of P.O.P. are soluble in hypo. This is to some extent true, but it is not the whole truth, because the action is not simple but complex. When prints are immersed in a fixing bath the first action that takes place is the conversion of the silver chlorides, citrates, etc. (insoluble in water), into silver thiosulphate—also insoluble in water, but soluble in an excess of hypo if sufficient time is given. But it is highly important that the hypo is really in excess, and this is best ensured by having a large quantity of solution, not by means of a small quantity of strong solution. A very safe practice is to have two fixing baths, and after allowing the usual ten minutes in one to transfer to the second fresh bath. It may seem an unnecessary refinement, but when lasting prints are desired it is the only safe course.

The addition of small quantities of strong ammonia to the fixing bath is advocated by some workers. To me it is an objectionable practice in that it causes swelling of the gelatine to such an extent that the prints curl and become unmanageable. I well remember one large batch of prints that I treated in this manner. In the wash water they curled to such an extent that the "guvnor" asked me if they were "pipe lights," and the time they took to mount was appalling. It is a decided

advantage when the fixing bath has no acid tendency, and, after platinum toning, should be decidedly alkaline. This condition can be acquired by the addition of a few crystals of washing soda without resulting in any unpleasant curling.

WASHING.

Having fixed our prints, it now remains to remove the hypo and the silver salts it holds in solution. This is the most tedious of all the processes, because experience has shown that the old method of placing prints in running water for two or more hours is not at all satisfactory. On the other hand, if prints are treated as described for washing previous to toning, the hypo is satisfactorily and expeditiously removed. It must be remembered, however, that hypo clings to the paper much more tenaciously than salt. Therefore, the action must be continued for much longer time. Half an hour of such treatment, every print having separate attention with the water warmed to 65° Fahr., should be satisfactory from every point of view. To make the matter easier and not throw too much responsibility on the water baths, I find it a good plan to wash each print, front and back, under the tap, thus removing all surface hypo before putting into the first wash water.

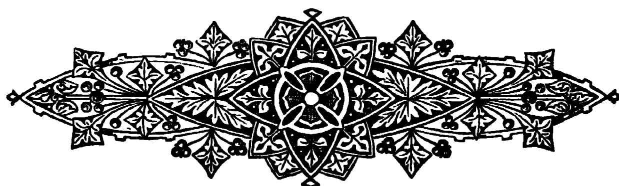
If prints are treated throughout in the manner indicated, there should be no need for a hardening bath at all; but if prints are at all soft the use of formaline is to be recommended. I deprecate the use of alum with P.O.P. It is not so efficacious as formaline, not so easily washed out, and is more likely to cause trouble through its natural acidity. Formaline also has the advantage in that it can be added to the toning bath (if sulphocyanide), to the fixing bath, or to the washing waters without detriment to the chemical action in progress.

P.O.P. may be dried with the natural surface of the paper, or the surface may be modified. Matt papers, of course, are not intended to be altered, but glossy papers can be given an almost mirror-like surface by squeegeeing on to a polished surface such as good glass. The prints should preferably be allowed to dry first and then soaked for a short time in water. The glass is prepared by thorough cleaning with whiting, after which it is dusted over with French chalk. The chalk is well rubbed on and polished off at the same operation, care being taken not to rub too hard or the surface of the glass itself will suffer. The wet print is then laid film down on the prepared surface of the glass, a piece of rubber sheeting or celluloid or oil-baize laid on top, and the squeegee can then be applied with considerable pressure in order to expel all air-bubbles. When the temporary covering has been removed the glass and adhering print are placed in a good draught to dry. The drying must be most thorough. Any attempt to remove the print whilst the slightest dampness is present will cause disaster. In summer time they may, when apparently dry, be placed in direct sunlight for a few moments when they will generally leave the glass spontaneously. If not, one corner can be raised by the finger-nail, and a steady pull will remove the whole print. In winter time *slight* warming near the fire may take the place of the heat of the sun. Glossy post-cards treated in this manner have a very finished look, also other glossy cards. The card P.O.P. although it does not need mounting, makes excellent prints which need no stiffening for mounting with glazed surface. They are best attached to the mounts by a narrow edging of hot thin glue. Glossy P.O.P. may have its surface modified in the reverse direction by squeegeeing to ground glass or matt opal. The beauty of the surface

so obtained is variable according to the fineness of the grinding of the glass. Such glass, for instance, as is used for high-class focussing screens will yield a beautiful velvety matt which is quite different from the surface of matt paper, and which for some purposes may be preferred. French chalk is not suitable for use on matt surfaces and should be replaced by the waxing solution sold for use with Barnet carbon tissue in double transfer process.

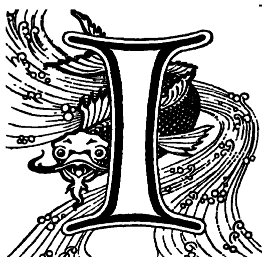
Throughout this article it has not been thought necessary to repeat formulæ that are found in every packet of P.O.P. Only those are given which imply a departure from the beaten track.

W. E. A. Drinkwater.



Bromide Printing.

ENLARGING AND CONTACT PRINTING WITH BROMIDE PAPERS.



IN the following article very little has been said about apparatus, since this is a purchasable quantity. Thus I have been enabled to devote more space to what is not a purchasable quantity—*viz.*, the economical manipulation of the process, in which are included a few general optical principles which govern it for the most effective working.

ENLARGEMENTS.

Of the photographic printing processes in vogue at the present time there is little question as to the beauty of the bromide process. At once possessing a greater range of possibilities than any other, it at the same time is capable in many instances of imitating and often excelling the leading feature in others.

For rapidity of production it has no equal, and with regard to large work is the most economical. The technique of the process is precisely the same as that in negative work, with some slight modifications. The fact that the printed image is latent or invisible should not be regarded by the uninitiated as a deterrent feature, since the exposure and development can be so adjusted as to render the production of a print perfectly under control, the graphic value of the negative being secured in the positive at will.

The printing of enlargements may be carried out by

daylight or artificial light, the subsequent manipulations being the same.

Artificial light is preferable, since, the light being a constant, exposures may be recorded and duplicate prints made at any time with certainty as to the exposure; this is impossible with daylight, as the actinic value of the light is never constant, even if a north aspect be chosen. I shall, however, give a brief description of the apparatus required for printing with both sources of illumination.

The general principles are as follows :—

The whole surface of the negative is as evenly illuminated as possible, and the image projected by means of a lens on to a screen in a dark-room. Fig. 1 shows a diagrammatic sketch.

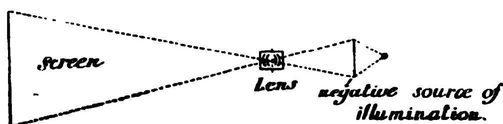


FIG. 1.

The sensitive paper is supported on the screen and exposed to the light passing through the negative and lens, a developable positive image thus being obtained. It is not my intention to describe in detail any special form of apparatus for either method of printing, since so much depends upon the opportunities and accessories available to the worker, but rather to give the essential requirements for carrying out the work.

For daylight, a window or an aperture in an outside wall, preferably facing north, is necessary. Against the inside of the wall the back of an ordinary camera is placed, with the negative in the place where the dark slide would be, and a piece of ground glass some two inches in front of it. The glass side of the negative

should face the light, and should be inverted. If buildings, trees, or other objects be in such close proximity as to obstruct the light, a reflector must be used, placed at such an angle as to secure the greatest amount of light from the sky; an angle of 45° is about the correct position, but it should be made adjustable. The image is thus projected through the lens of the camera on to a screen, which, the camera being a fixture, must be movable. The amplification of the image is unlimited, depending solely upon the definition required.

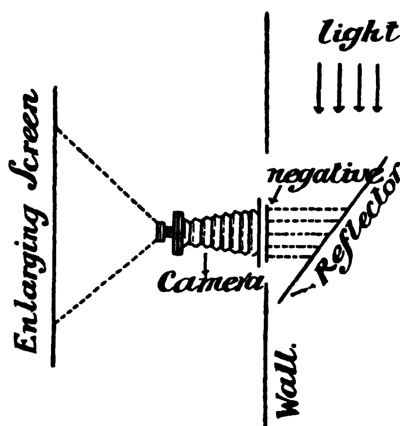


FIG. 2.

It is hardly necessary to state that no actinic light, except that which passes through the negative and lens, must be admitted into the room. A diagram of the general arrangement of a daylight enlarging apparatus is shown in Fig. 2.

There is another form of enlarging apparatus which may be used for either day or artificial light, consisting of a camera body in which the sensitive paper is enclosed; but since the degree of enlargement is limited to the size of the apparatus, and the same work may be done with one's camera in a dark-room as described,

the possession of such an instrument seems to me totally unnecessary, and not worth describing.

For enlarging by artificial light, the apparatus required is rather more elaborate, due to the necessity of some special form of illuminant, and its seclusion from the dark-room.

Those who would construct their own lantern should know some of the optical considerations necessary for the most efficient illumination of the negative. As before stated, it is all-important that the negative be as evenly illuminated as possible, and providing this condition be observed, the method of doing it is entirely a matter of choice. But where it is a question of efficiency rather than economy, we have only one method to adopt ; this consists of the use of a condenser.

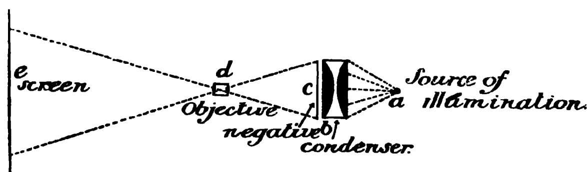


FIG. 3.

It is not possible, in the space at my disposal, to enter into the details necessary for the construction of an enlarging lantern, the principles of which are identical with those of an optical lantern ; on the other hand, the proper manipulation of the instrument is of great importance, and a few general principles which must be adhered to for the most efficient working are necessary. Fig. 3 is a diagrammatic sketch of the principles controlling an enlarging lantern.

A is the source of illumination, and for the most effective working should approach as nearly as possible a mere point of light of great intensity ; hence an arc light is the best to work with,

B, the condenser, consists of two plano-convex lenses placed with their convex sides nearly touching. They have for their purpose the condensing or collecting of the rays of the illuminant and projecting them through the negative C to a focus in the centre of the lens D, whence they are transmitted to the screen E.

Now it is essential that the illuminant should be so placed that the rays projected through the negative should come to a focus as near the centre of the objective as possible, otherwise there will be a loss of illumination. In this way the degree of amplification governs the distance from the objective to the negative, and this in

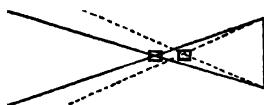


FIG. 4.

its turn governs the distance of the light from the condenser. Fig. 4 will illustrate this

Let the hard lines represent the correct position of the illuminant and lens for a certain degree of enlargement, then if a greater degree were required it is obvious that the distance between the lens and the condenser would be less; therefore, in order that the whole of the rays collected by the condenser may pass through the lens, the focus of the light on the lens side must be altered, and this can only be done by increasing the distance of the light from the condenser, as illustrated by the dotted lines. This is a most essential point in the effective working ot a lantern, and when the position of the lens is found for the size of enlargement required

the carrier containing the negative should be removed, and the position of the light found by adjusting it till it gives a clear evenly illuminated disc on the screen. With regard to the various parts of the apparatus a few brief words will suffice to guide the worker in his choice of an instrument.

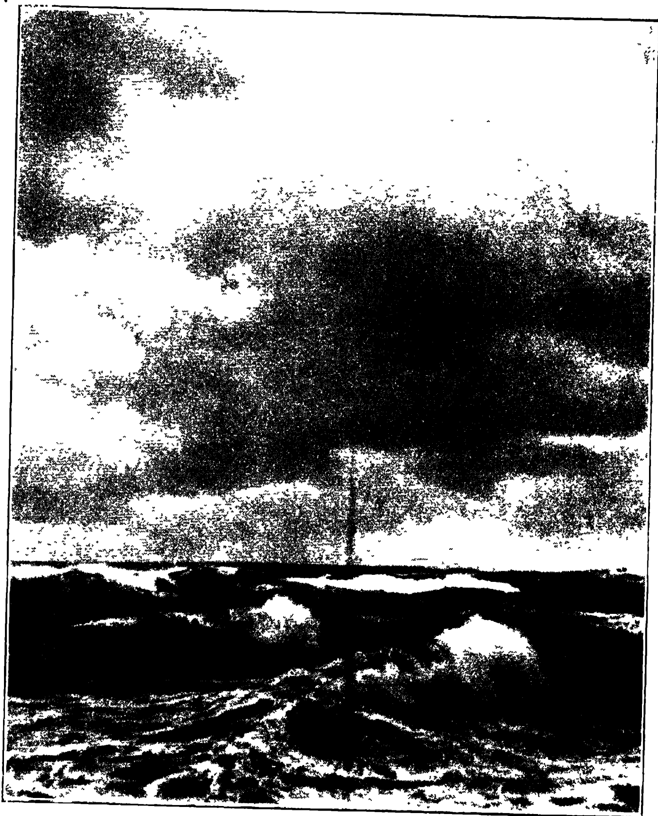
The Illuminant.—The choice of the source of illumination is governed by two factors—efficiency and convenience. I use the word convenience in the broadest sense. As before stated, a point of light is optically the most efficient form, the reason for which is obvious, for, since this point must be central to the focal axis of the condenser, the rays will be more evenly distributed over its surface.

Take as an illustration the difference between the point of ignition of an electric arc and that of a flat-flame burner. Say the flat flame had a surface area of 2 inches square, then we should have light radiating not only from its centre, but also from innumerable points contained within its area; and since a condenser is simply a lens (with a focus), it would be impossible to bring all the points of light into optical focus at once; hence we get an uneven distribution of rays over the surface of the condenser. On the other hand it is possible, and better, so to diffuse the light as to present a universally illumined surface over the whole area of the condenser, and thus produce a result similar to that which obtains in daylight enlarging.

This is undoubtedly the best method of illumination, but unfortunately the means of doing it involves a loss of light, the extent of which is governed by the diffusing medium employed.

Few of us, however, are able to indulge in an arc light, and so we must take the next best thing.

Acetylene is a good illuminant, and owing to its high



SEA-HORSES
BY F. J. MORTIMER, F.R.P.S.

actinic value can be used with a comparatively small point of ignition. Its use, however, involves extra and somewhat bulky apparatus, and unless a considerable amount of work is contemplated so that the apparatus may be kept in constant use, I very much doubt the advisability of going to the expense when such an excellent substitute is to be found in the incandescent mantle and ordinary coal gas. Personally, I have used this form of illumination for several years, and without any diffusing medium between the burner and condenser; I have never found my exposures to be excessive even when doing work as large as 40 in. × 30 in. The longest exposure ever required was that for a negative intended for contact printing, and for a 36 in. × 30 in. print, with $f/16$, the time was fifteen minutes.

A similar print from a negative made expressly for enlarging requires only from one to three minutes.* Magnesium ribbon will find no place in my category, since I have proved it to be extremely unconducive to the economical working of the process. There remains but the oil-lamp, and as a form of illumination, providing cleanliness is observed, a very excellent one indeed. I used a lantern with this form of illumination for five years, and never once had occasion to regret its efficiency. *But it was kept clean!* One point I would impress upon intending purchasers is to secure the pattern of burner known as the "Duplex" (Fig. 5). Should it be desirable to use a diffuser between the burner and condenser in either method of illumination, in order to present a sheet of light to the face of the condenser it is advisable to employ finely-ground glass in preference to any other medium, as this involves the least loss of light. Two

* Should the worker find that he gets an image of the mantle on his screen, the difficulty may be got over by lightly etching the glass chimney with some sand-paper.

sheets of glass may be required and if so they should be placed about one inch apart.

The Condenser.—This is generally in the form of two plano-convex lenses mounted together, with their convex sides nearly touching, as shown in Fig. 6.

This answers fairly well with the smaller sizes, but when the diameter is large a good deal of light may be lost, hence the advisability of employing a diffuser.

The Lens, or Objective.—This is a factor of great importance in the enlarging lantern, and when the expense is of no great material import some consideration should be given to the optical efficiency. That the lens which took the photograph will serve to enlarge it is true

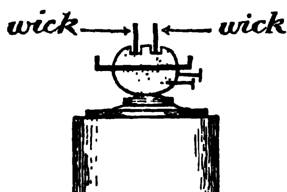


FIG. 5.

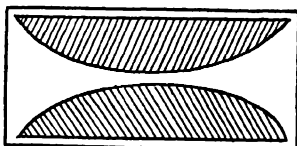


FIG. 6.

enough, and in some cases may be the best one to use, but it must possess certain desirable features. If it be of too short a focus it will generally be too near the condenser to be within the focus of the light from that side, and will therefore be unable to pick up all the rays of light emanating therefrom, thereby engendering a loss of illumination, and the presence of a coloured ring on the outer edge of the disc of light on the screen. Figs. 7 and 8 will show this clearly.

In Fig. 7 we see what happens when a lens of too short a focus is used, but when one of longer focus is substituted the whole of the cone of rays passes through and is utilised (see Fig. 8). Hence it is advisable to use, say, a half-plate lens on a quarter-plate apparatus.

The type of lens used should be of the rapid rectilinear form, and have as large an effective aperture as possible. One of the latest forms of flat field lenses is the best, owing to their fine definition with a large aperture. A portrait lens may be used, and has the advantage of rapidity, but its circle of definition is very limited.

The Dark-room Light.—This is one of the most important factors in successful work, and deserves some

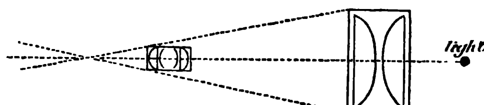


FIG. 7.

consideration. *You must see what you are doing.* Now rapid bromide paper is about ten times less sensitive than an ordinary dry plate; it follows, therefore, that a light ten times stronger may be used. The colour of the light also is of great importance, since the depth of tone of a positive varies considerably with different tints. Undoubtedly a yellow or canary tint is the most effective.

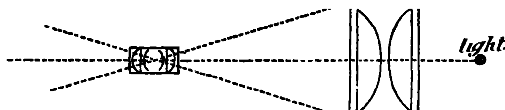


FIG. 8.

So long as the light is safe, it is immaterial how much there is of it, except that the greater the area of illumination the better we can see our manipulation. The law of the intensity of light radiating from its source is as follows: *The intensity of a light is inversely proportional as the square of the distance from its source.*

That is to say, if the value of a light at one foot from its source is equal to 100, then at two feet it will be equal to 25, at three feet 11·1, at four feet 6·25, and so on. It

follows from this, then, that if our light has no effect on a piece of bromide paper at a distance of one foot, and for a period of five minutes, at two feet it may be exposed without danger for twenty minutes, and at three feet for forty-five minutes. For the "safety" of the lamp a good deal depends upon the form of light used.

If an oil-lamp is chosen, one thickness of canary fabric should be sufficient, providing the distance between the burner and the fabric be not less than six inches. If an ordinary gas-burner is used, one thickness of the fabric and one or two pieces of tissue paper.

An incandescent mantle requires two thicknesses of the fabric. Yellow glass may be used if preferred, but must be covered with some diffusing medium, such as tissue-paper; on no account should a dark-room lamp be used, either in negative or positive work, without the light being diffused. In the construction and testing of a dark-room lamp for bromide work the following methods may be adopted If large work be contemplated, an area of not less than one square foot of illuminating surface should be used.

Obtain light from as many sides as possible, but from the front or working side the light must be shielded from the eyes. It is convenient to use the lamp for negative work by interposing a screen of ruby fabric.

Test the light by exposing a piece of bromide paper, half of which is shielded, at a distance of six inches from the lamp, for a period of half an hour, and develop it with a strong developer. Should there be any signs of fogging, cover the fabric with one thickness of tissue-paper and repeat the test. Continue to do this if necessary till the light is "safe," but do not add so much tissue-paper as to reduce the light to the same degree as would obtain by the use of an extra thickness of

canary fabric. Having certified the safety of the lamp to the above extent, a piece of bromide paper at two feet from the light is safe for a period of eight hours. The worker may, of course, reduce the experimental time to any degree he likes, and so obtain a correspondingly stronger light.

The Negative.—Any kind of negative may be used for bromide printing, but by far the best results are obtained from negatives specially made for the process. When daylight is used for printing we are not quite so dependent on the quality of the negative, as the light is more penetrating. With artificial light the negative should essentially be a thin one, but of full gradation and detail; and here let me give a word of advice as to the best developers to use. With regard to the production of density and detail in a negative, *all* developers are alike, time being the only interfering factor; but, with regard to the stage in development at which these same make their appearance, there is a wide difference between the various developers. Roughly speaking, some produce density first, the detail slowly following; others produce detail first, the density slowly accumulating later. It is from the latter kind we must choose, the reason for which is obvious.

Since it is essential that the negative must be fully graduated, clear and brilliant, without fogging or clogging of the shadows, and at the same time possess all detail, it follows that it will be what is technically known as 'thin." A developer which produces the density first and compels us to wait for the detail, obviously cannot give us the above essentials. But where we can get the full scale of gradation and detail almost immediately, and control the density at will, such a developer must be used. And let me here add that, in my experience, I have found that the best developer for the paper is the

best for the negative—with modifications, of course.

There are two developers most suitable for the work. One is a combination of metol and hydroquinone, and the formula given is the result of a series of experiments I carried out expressly for the purpose :—

NORMAL DEVELOPER.

Metol	100 grains or	10 grammes
Hydroquinone	50 ,, ,,	5 ,,
Sodium sulphite	3 ounces ,,	130 ,,
Potassium carbonate ..	1½ ,, ,,	65 ,,
Water	40 ,, ,,	1,750 c.c.

Ten per cent. bromide of potassium to be added as required.

The keeping quality is practically indefinite, and it may be used at full strength or diluted.

The other is an old favourite of mine, of the qualities of which I cannot speak too highly for this work.

NORMAL DEVELOPER.

Rodinal	30 minims
Water	1 ounce

Ten per cent. bromide of potassium to be added as required.

Using this, the negative should be developed rather farther than with the first formula, as there is a considerable loss of *apparent* density in the fixing bath.

THE PROCESS

Enlarging.

Before giving the details of the process I wish to emphasise one very pertinent fact. *In this, as in other printing processes, there can be little hope of successful work if no more is known of the chemical and physical conditions under which the process works than is given in the manufacturer's instructious which accompany each packet of paper.* I will therefore give a brief account of the cause and effect of bromide printing. It may be as well to remark here, that the details of the process apply equally to that part of bromide work known as "contact printing."

Bromide paper is made by coating paper with a gelatino-bromide of silver emulsion, almost precisely

similar in composition to that of a dry plate, but much less rapid. The process necessary for the production of a graphic deposit of silver is precisely the same as for a negative, although the manipulation is required to be rather more delicate.

The simple chemistry is briefly this.

When light acts on the paper it effects a change in the emulsion, which change is only rendered visible on development. The extent of this change has a two-way limit, technically known as under-exposure and over-exposure. The actinicity or power of the light, or the period of its duration, acting on the paper after passing through the negative, may have been insufficient to effect the necessary change in the emulsion in all and various parts, to yield a correspondingly correct positive or development. This is the under-exposure limit. On the other hand the exposure may have been too prolonged in all or some parts, in which case the change effected in the emulsion has passed the limit and commenced to decompose it, or render it beyond control for the production of a graphic image. This is the limit of over-exposure. By this we see that under-exposure is irremediable; but with over-exposure we have both a chemical and physical control, providing it be not excessive. *The action of light on an emulsion may effect a change to such an extent that the image is developable to a limited or fixed extent.*

I emphasise this statement because so many failures are due to ignorance of the fact.

Development is simply the reduction of the light-affected bromide of silver salt to the metallic state.

The rapidity of reduction is governed by the strength of the reducing agent, but over-exposure develops more rapidly than under-exposure with a developer of similar strength.

Providing there be sufficient of the reducing agent present a weak, or dilute, developer will produce precisely the same effect as a strong one, time being the only consideration; and since the effect of the exposure is only visible on development it were better to have the reduction under control and the possibility of rectifying faults, both selectively and generally.

The perfect reproduction in the positive of a negative is wholly dependent on the actinicity of the printing light, hence we may never be able to get the correct exposure for a certain negative; but practically, the scale of gradation in the negative can be reproduced inversely in the positive. In enlarging, this possibility is somewhat restricted, since we cannot alter the distance of the printing light; therefore, generally speaking, when once a negative with a particular scale of gradation has been found to be most effective with the light used, it should be kept as a sort of standard guide. While under-exposure is irremediable, we can both chemically and physically exercise a considerable amount of control over excessive exposure, providing the emulsion has not been affected to a state of decomposition. Physical control is rarely necessary, except in the case of selective repression or accentuation, when glycerine may be added to the developer to restrain development. But if the method of weak development be employed, the same control may be exerted, and for the same purpose.

When a soluble bromide, such as potassium bromide, is added to a developing solution, *either before or after the first appearance of the image*, by a rather complex chemical reaction, the parts of the emulsion least affected by light are more difficult, or at least require more time, to reduce to the metallic state, the bromide at the same time having a preservative action from decomposition over the whole of the emulsion. If an excessively over-exposed print were developed without the presence of a

bromide, or other restraining element, the image would consist of a mixture of decomposed and reduced silver, presenting a muddy, flat, and *horrible* appearance.

By the addition of a bromide, however, the development of the print may be governed by the depth of tone of the shadows, or parts *most* affected by light, leaving the other parts to the will of the bromide—as indeed to a great extent we must, since the effect varies nearly in direct proportion with the quantity added. Some of my readers may doubt my statements as to the hopelessness of under-exposure; believe me, such methods as warming the paper, etc., are of little use, only tending to fog the emulsion.

Now, if the foregoing brief outline of the chemical and physical conditions pertaining to exposure and development be borne in mind during the manipulations of the process, I am confident that the worker will have every chance of being successful. Bromide paper, although of delicate constitution, will stand an enormous amount of chemical treatment if properly handled. It is quite a false idea that it easily takes on stains and markings. Keep your solutions and fingers clean and you keep your paper clean.

Its keeping quality is beautiful, but it must be kept in a dry room. I recently used an opened packet five years old, which had been put away in a drawer in my study among some letters, and it was as good as a batch of paper which had been specially made for me that month by Messrs. Elliott & Sons for some experimental work I was at the time carrying out.

The use of a drawing-board, or similar apparatus, as a screen for focussing on, and for pinning up the bromide paper ready for exposure is, in my opinion, far preferable to enclosing it between pieces of ground and plate glass, as with this method the amplification is bound to be

limited; it needs but a little care to remove the bulges which sometimes appear when pinning the paper on the screen

To print, or expose, either by daylight or artificial light, the negative is placed in the carrier upside down, and with the glass side towards the source of illumination, and focussing effected by racking the front of the camera in and out in the usual manner. The screen should either be painted white, or covered with white paper, and must be perfectly rigid. If the camera or lantern be movable it is a good plan to fix the screen against a wall.

Should the lens require stopping down in order to secure greater definition, the law relating to the ratio of exposure to the "*f*" values is absolute in this case; therefore if an exposure of one second be required with *f*/8, then *f*/11 will require two seconds, *f*/16 four seconds, and so on. The use of a piece of yellow glass in the place of the lens cap is an absolute necessity. It is hardly necessary to say that the greater the amplification, the farther away will be the lantern from the screen, with a corresponding increase in the exposure. Curiously enough, however, I have found out, and other workers have corroborated, that the law of the intensity of a light does not hold in this case. But there is a very practical method of estimating the increase in the exposure by a simple calculation, as follows. Say the exposure for a 10×8 was 5 seconds, and it is required to know the time for a 15×12. The area in square inches of the greater enlargement (15×12) divided by the area of the smaller (10×8) multiplied by the time for the smaller, gives the required time for the larger print.

Example: $\frac{15\times12}{10\times8}\times 5=\frac{180}{80}\times5=11{\cdot}25$ seconds.

This must on no account be taken as a fixed law, but simply as an excellent guide for the trial exposures.

Trial Exposure.—In no case of a first print must this preliminary operation be omitted. For prints up to 12×10 it is simple, but for larger work must be somewhat elaborated, if only for the sake of economy. Focus your image, and with yellow glass in front of the lens, place a small piece of bromide paper over a typical part of the image on the screen, preferably containing both high light and shadow. Expose by removing the yellow glass *and counting by means of a watch or similar instrument. This trial piece must be developed with a developer of normal strength, and developed as far as ever it will go.* For larger work it is advisable to use, say three pieces of paper for the trial exposure. First, a piece is placed over the densest part of the image, a triple exposure is then made by covering the paper with a piece of card, and giving three exposures of equal duration by uncovering a third part of the paper at definite intervals. Thus, if one-third received 5 seconds, two-thirds will receive 10 seconds, and the last 15 seconds. By this means we can find the exposure necessary for the densest part of the negative to just print through.

The other two pieces of trial paper are now placed on the lightest part of the image, and an intermediate, or half-tone, respectively, and the determined exposure given. From the results obtained we are able to judge with considerable accuracy the length of the scale of gradation, and the depth of tone it is possible to acquire with that quality of negative and light.

The exposure of the large sheet may now be proceeded with.

If the greatest possible definition be required, the paper should first be thoroughly wetted, also the surface of the enlarging screen, and the paper, after being allowed to drain, placed in the position it is to occupy on the screen

A perfectly clean wet sponge which is free from grit may be used to smooth out any bulges or creases in the paper. Needless to say the paper will be in a very greasy and slippery condition, and must be handled with great care. When wet, it stretches considerably, it is therefore advisable to soak it for some three or four minutes. It must be not pinned to the screen, but allowed to support itself by its own suction; should the exposure exceed fifteen minutes it may be sponged over at intervals. On drying, the paper will contract to its original state, thereby reducing to a corresponding degree any diffusion in the image. I have found this very beneficial in architectural subjects.

After exposure, either in the wet or dry state, the print is immersed in water, and to do this so as to ensure the complete absence of air-bells, the following method is most efficient. Fill the dish nearly full with water, and taking one end of the print, place it under, then slowly pull the rest of it through and under. Allow it to soak for at least three minutes, more if it be thick paper, then pour off the water and, standing the dish on end, allow to drain completely. These manipulations are absolutely necessary for facility in working.

Weak Development.—Before giving my method of weak development I wish to say a word on the *rationale* of the process. The too prevalent method of developing a bromide print by flooding it with a strong developer and snatching it out immediately it shows signs of over-development is against all the principles of efficient and economical *technique*, clearly showing a want of the most elementary scientific knowledge of the process.

Since, as I have shown, the complete reduction of the silver is entirely dependent on a sufficiency of the reducing, or developing agent, providing we have that, then the duration of development will be in direct ratio



Fig. 9.—First Stage.



Fig. 10—Completed Print.

with the strength in percentage by volume. Hence, if we can regulate the speed of development at will, and eventually produce precisely the same state of reduction quickly or slowly, it is obvious what advantage is gained when we consider the question of individuality and certainty of results.

The speed of development being a personal matter, the strength of the developers given may be modified as desired, but as the effect of the exposure can only be seen on development, it is very important that the image be first brought up to such a stage, that, should there have been any error in exposure either way, the silver has been reduced to such a state that no material damage has been done; while at the same time the scale of gradation is visible to such an extent that we can see the whole, or nearly the whole, length of it. This state I have called the "first stage of development." Fig. 9 shows a print at this stage. In practice it very much resembles a platinotype print before development. Fig. 10 shows the completed print.

The developers given for the negative work are recommended, but the *normal* solution is just half the strength in both cases, made by doubling the quantity of water.

To bring a print to the "first stage," dilute the developer at least six times, preferably ten times, using the smallest volume possible. For a 30×24 I use six ounces. Now exercise a little patience. Correct exposure is indicated in the "first stage" by a visibility of the whole of the scale of gradation, with detail in shadows and high-lights, and even in this weak and ghost-like state there is a certain amount of crispness. Stop development by rinsing the print, and decide upon its future state. I might say here that *correct exposure is technically known as that which will give the most perfect rendering of the gradation of the negative, with*

the greatest depth of tone; but it does not necessarily follow that it will give the best print; this is a personal equation.

If weak development be continued the print will pass through all intensities, from shadows of dove grey to deepest black, governed, of course, by the quality of the negative.

Development may be stopped at any stage, and a stronger solution applied selectively to accentuate where desired, but if this be done, the print must not be developed to its full limit, otherwise, the accentuated parts would be lost.

Depth of tone is obtained at will by strengthening the developer. There is one peculiarity in the development of bromides, which should be carefully noted and allowed for. When a print is fully developed and immersed in the fixing-bath, a considerable clearing action takes place, rendering the intensity much greater. But with an under-developed print this does not happen, or but very slightly, and a knowledge of the peculiarity can only be obtained with experience; the intensity of the print should be judged by transmitted light.

Under-exposure in the "first stage" is indicated by an absence of detail in the high-lights, and a much shorter scale of gradation. Now, although I have previously said that under-exposure is hopeless, it is nevertheless a fact that with weak development you can secure a satisfactory print which has been under-exposed to the extent of 30 per cent., when with rapid development the result would be very indifferent.

Continue with the weak solution till the print seems to "hang fire," and then strengthen very slightly; if it still hangs back, strengthen more, and if there is no further development you may add as much as you like but you will get no further reduction.

The use of bromide plays such an important part in development that it is advisable to omit it from the compound developer and add it when required from a dropping bottle; the manipulation is much more delicate and certain. It is unnecessary to use any in the "first stage" developer with the formulæ given, except in hot weather. On no account use it with prints that have been much under-exposed. In all cases it has the effect of steepening the scale of gradation if the development is stopped within the limit of reduction.

Over-exposure is indicated in the "first stage" by a complete visibility of the whole scale of gradation and all detail, but of a very flat appearance, there being little difference between shadow and high-light. If checked at this stage, over-exposure to the extent of 100 per cent. may be controlled and rectified to give a satisfactory print. If very excessive, add three or four drops of bromide to your weak developer, and continue for a little; now strengthen your developer in stages from quarter, half, three-quarter, to normal, adding three drops of bromide per ounce of developer at each stage, and continue development with this till the desired depth of tone is obtained.

Slight over-exposure and control during development is at once the safest and best method of producing a bromide print. In my own practice I invariably over-expose to the extent of from 5 to 10 per cent. on the estimation obtained from the trial slips. At the "first stage" the developer is increased to one-sixth normal with one drop of bromide, then in stages as required up to the normal, with the addition of one drop of 10 per cent. bromide at each stage. With regard to individuality you can work your will with the print, having it completely under control.

Sponge development may be applied with equal facility.

Exceptionally hard negatives and those which have been under-exposed, containing great contrasts, may be successfully treated in the following way.

Obtain the correct exposure—that is, the exposure necessary to just print through the highest light—and develop with a normal developer to the limit of reduction.

Having found this, increase it for the intended print by three or four times. Develop with a normal solution diluted from six to ten times till it has attained nearly the desired intensity. This at first will entail some careful judgment, but a little practice will soon enable one to perform it with accuracy.

Fix and wash the print, and then bleach and intensify as described under intensification.

By this means negatives used for any other printing process may be equally well adapted to bromide work. In this process prints should be judged by reflected light, not by transmitted light.

Combination Printing.—Here we have one of the most fascinating and necessary adjuncts to pictorial work. Now with regard to the manipulation, combination printing in the bromide process is considerably more difficult than in any printing-out process, but not by any means beyond the capabilities of the tiro, while at the same time the possibilities with regard to effect and individuality are infinitely greater than with any other form of photographic printing.

The simplest form is that of sky printing. This may be carried out in two ways; by a double exposure before development, in which case the exposure for both landscape and cloud or sky negative must be accurately determined beforehand; or by printing and developing the landscape first, and re-exposing the wet paper for the sky, in which case the exposure for the landscape only need be very accurate.

The first method is an extremely risky and uncertain business altogether, and as after a very few efforts I gave it up in disgust, I am perhaps not competent to speak on its merits, if it has any.

The second method, on the contrary, is extremely simple and efficient, needing but a little care and patience.

It must be remembered that bromide paper after the application of the developer becomes slightly less sensitive, and more so in the presence of bromide, so that some allowance should be made for this if the print is exposed several times.

If the depth of tone required in the landscape is such that it may be developed right out—that is, as far as it will go—then the printing and development of the sky is a very simple matter, being controllable at will.

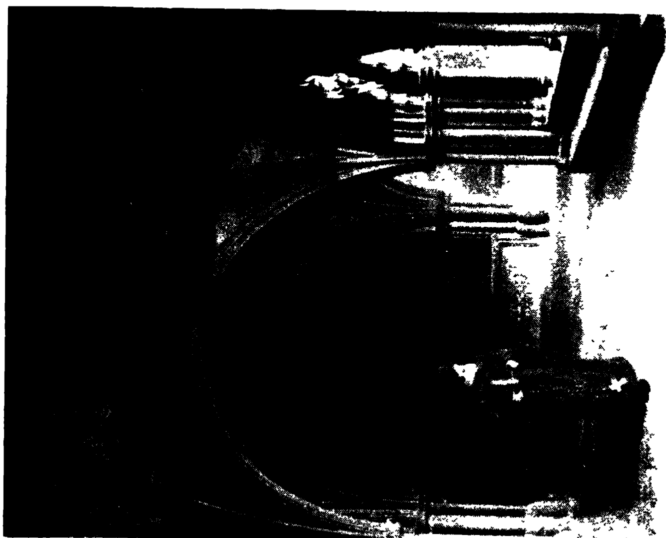
Ascertain the exposure for the landscape, and develop it with a normal developer as far as it will go; then rinse the print and allow to drain by standing the dish on end. Now place your sky negative in position, and if not already found make trial exposures for the sky, and develop with a normal developer. The wet but drained print is now placed in the proper position on the screen by holding it carefully but firmly at the top, and allowing the bottom to rest on or touch the screen first, the yellow glass in front of the lens enabling this operation to be performed with ease.

If the previously determined exposure be increased by a tenth it should be quite sufficient for a second printing. The landscape portion of the print is shaded in the usual way with a piece of card held at such a distance from the print as to give a marginal line of diffusion about a quarter of an inch deep; and if the horizon line be very uneven the card must be roughly cut to it, but smaller to such a degree as to fit the

horizon line when held at the stated distance from the print. During the exposure the card or shield is slowly lowered till the sharp edge of the horizon is distinctly visible, and then slowly raised till it just disappears. This manipulation should be repeated several times. The print is now redeveloped and controlled to obtain any desired effect in the sky. Where the development of the landscape has to be controlled for any desired effect, the sky may be developed with a brush or cotton wool, the print being inverted ; or, after some technical skill has been attained, the exposure and development adjusted to suit both printings.

In the case of compound work where landscape is added from another negative, or figures and other incidents are to be included, the manipulation is considerably more difficult. I have found that by far the best plan is to make a contact print of the figure or incident, and after accurately cutting it out, lightly paste it on the paper in the required position before the first exposure. This leaves a blank space to be filled in the second printing. The print from which the figure was cut is now pasted on the *glass side* of the corresponding negative, in such a manner as to leave only the figure visible. Place the wet developed print on the screen in the usual way, but in accurate gauge with the projected figure or incident, and make your exposure. I have made eight printings on Barnet platino matt paper in this way when making up a landscape, without any deterioration of the emulsion ; and it speaks well for the rapidity and stability of bromide paper when I say that the work only occupied three hours, and the whites remained perfectly pure.

Fig. 11 shows a print from original negative. Fig. 12 shows a combination print, the figure of the monk being photographed in my own house. The excessive high





lights and other parts of the picture have also been manipulated during exposure.

Variation of Perspective.—The possibility of altering the perspective of a picture is a feature of considerable importance in enlarging. Thus in architectural work, where the perspective is faulty owing to the plate not having been vertical at the time of the exposure, it may be corrected by inclining the screen on which the image is projected to such a position that the *bottom* of it is nearer the lens than the top. In this way any converging lines will be straightened, but it generally involves the use of a smaller stop if universal definition is required. The worker will no doubt also see further advantages for pictorial purposes.

Fixing.—The fixing bath may be of the same strength as that used for negatives—the more quickly the print is fixed the better; it should preferably be of the acid variety. Five to seven minutes' immersion in such a bath is sufficient. The following is a good formula:—

FIXING BATH.

Hyposulphite of soda	1 lb.
Sodium sulphite	3 ounces
Citric acid	¾ ,,
Water	80 ,,

Dissolve the sodium sulphite and citric acid together, and add to the water in which the hypo has been dissolved. After some use the activity of a fixing bath should be tested, by immersing in it one-half of a strip of unexposed bromide paper, when the yellow tint of the emulsion should instantly disappear.

Prints should be transferred to the fixing bath without previously rinsing in water.

Washing.—The washing of large prints is not an easy matter if one has no special apparatus for the purpose. A very efficient method is to support the print in the dish or on a drawing-board, placed at an angle in a bath

or sink, and by means of a rubber tube attached to the tap gently squirt water over the face and back of the print. In this way a print may be perfectly freed from hypo in fifteen minutes.

A very excellent apparatus for the purpose can be made at a moderate cost. This consists of a small

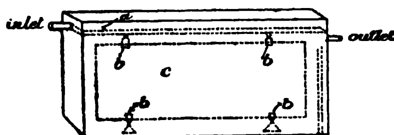


Fig. 13.

narrow tank with an overflow from the bottom. (See Figs. 13 and 14).

The tank is made of tin, or wood made waterproof, and need not be more than 2 inches wide. A rod A is supported on two ledges, and from this the paper C is suspended by clips B, and held down by small weights attached to clips at the bottom. All hypo-contaminated

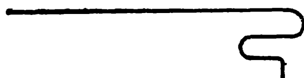


Fig. 14.

water is carried off from the bottom. Water entering at a rate of a pint in half a minute will wash a print in an hour. If any such vessel is available as a makeshift, the overflow may be made with a piece of compo pipe bent as shown in Fig. 14, the long end being placed in the vessel and the short bend hanging outside. The flow must be started by suction.

INTENSIFICATION.

Should there be a lack of depth of tone, or intensity, in a finished print, it may be increased by a process of intensification.

For this purpose I would strongly advise the worker to avoid any formula containing a salt of mercury. The following is one of the very best.

Soak the print in water for five minutes and then immerse in the following solution :—

Copper sulphate	200 grains
Potassium bromide	200 „
Water	10 ounces

The print will bleach in about three minutes. Wash for one or two minutes in running water, or four changes in still water, then apply a 5 per cent. solution of nitric acid for a minute or so.

Wash for one or two minutes and redevelop with a semi-normal developer till the desired intensity is attained. Wash for fifteen minutes. If the intensification is insufficient, the print may be again bleached and re-intensified as often as desired.

Greater intensification is obtained if the print be exposed for five minutes to daylight immediately after the nitric acid bath.

Still greater intensification may be secured if a 2½ per cent. solution of nitrate of silver be used before the developer, and the developer applied after if necessary.

Care should be exercised in using the nitrate of silver solution, as staining is very liable to occur if the strength be too great or an insufficient volume of solution be employed. Remember that the same control by means of weak development and bromide of potassium obtains here.

REDUCTION.

If a print be over-developed, or the intensity too great, the process of reduction may be resorted to. But it is my experience that all processes up to the present time are anything but satisfactory, and their application should be avoided if possible.

The following is one of the best :—

Ammonium persulphate	.. ..	10 grains
Water	.. ..	1 ounce

Immerse the print in the solution, which must be freshly made each time.

It is some time before the action commences, but this is indicated by the solution becoming milky, and from this point the print must be carefully watched, and the dish rocked continuously. When the desired degree of reduction has been reached, the print is instantly transferred to a 10 per cent. solution of sodium sulphite, which arrests further action. Allow to remain in this solution for five minutes and then wash for fifteen.

I have found that reduction by any method interferes with subsequent colour toning.

TONING.

The three primary factors which combine to create the precedence the bromide process has, or should have, over all others, are—rapidity of production, variation of the range of tone in black and white, and the possibilities of colour toning.

The facility with which the many and various tones may be obtained renders this part of the process extremely fascinating. Colour may be obtained in two ways—by substituting another metal for the silver, or forming an amalgam.

It is to be regretted that the formation of an amalgam in some cases has a tendency to jeopardise the permanency of the tone, if not the image itself; and it is therefore advisable, where possible, to secure the tone by substitution.

In a paper read before the Royal Photographic Society, December, 1902, I gave a formula for the substitution of platinum for the silver, with the obtention of a fine sepia tone, the beauty of which amply repaid

me for several years' patient research in the endeavour to secure it.

The formula is as follows :—

Potassium chloroplatinite.. ..	1 grain
Mercuric chloride	1 „
Citric acid	9 grains
Water	1 ounce

In this, as in all other processes, soak the print for fifteen minutes before toning.

The speed is about the same as that of a P.O.P. bath ; but in large work it is more economical to stand the dish containing the print in a nearly upright position, and apply the solution by means of a broad camel-hair brush, *which should be used for nothing else* ; the solution collects at the bottom of the dish, thus enabling a smaller volume to be used

One or two drops of 10 per cent. bromide of potassium prevents any tendency to staining, and produces intensification. A great feature in the above formula is the fact that the depth of tone of the finished print will be precisely the same as before toning, except of course that the scale of gradation will be altered by changing the colour from black to sepia.

Wash after toning for five minutes.

The tone may be changed to its original black colour, but of greater intensity, by immersing in the copper bleaching solution for a few minutes and redeveloping.

TONING WITH COPPER.

The following will give a range of tones from purple brown to cherry red :—

Copper sulphate, 10 per cent. ..	75 minims
Potassium citrate, 10 per cent. ..	1,000 „
Potassium ferricyanide, 10 per cent.	66 ,

Mix the copper sulphate and potassium citrate together, then add slowly, stirring the while, the potassium ferricyanide.

The action is fairly rapid. Wash for half an hour

There are many and various other toning formulæ for all colours, for which the photographic Press should be consulted; but among some of the most recent is one for sepia tones, in which I converted the silver image into silver bromide and from it substituted silver sulphide.

Silver sulphide being as stable as the deposited silver of the original image, the permanency of the print is assured. The process is as follows:—Bleach the print as for intensification, then after washing from the nitric acid apply a 2 per cent. solution of sodium sulphide. Toning is instantaneous, and washing for ten minutes is only necessary to remove the excess of toning agent.

ENLARGED NEGATIVES.

Where a number of large prints have to be produced from one negative, or it is desired to make a large print by another contact process, it is often quicker and more economical to make an enlarged negative for the purpose.

Three different mediums are available—glass, negative paper, or bromide paper. Where economy as well as efficiency is a consideration, the negative paper is preferable.

There are two methods of carrying out the process—one by making a positive, by contact, from the negative; the other by making an enlarged positive, and the negative by contact with that. It is a much-disputed question as to which is the better way, but both have their good points.

In the first method, the small positive must be so made as to contain all the essential qualities for a perfect enlarged negative, since little or no retouching can be done on it, whereas by the second method any imperfections may be remedied with facility on the enlarged positive.

In both methods there are one or two points which must be rigidly observed with regard to the projected image. First, the source of illumination must be perfectly steady, whether a condenser be employed or not, for, if there be any fluctuation, either in the intensity or the projected rays, of the light emanating from the lens, you will infallibly get a softening, or diffusion, in the lines of the image ; second, if glass plates are used, *they must be backed*, otherwise you will get diffusion.

In making the small positive, the essential features required are full detail, thinness, and clearness, without actual clear glass in the high-lights. A developer similar to those given for enlargements is one of the best suited for the purpose. Either lantern plates or slow ordinary plates may be used for making the positive, but in either case they must be well under control during development, so that they may be stopped at any desired stage

Remember, when judging the density, to view the positive or negative by transmitted light

Obviously, a developer which produces detail first while the density slowly accumulates is the best one to use, although in manipulating it the worker must constantly bear in mind that he is reversing the usual order of things and points which call for observation. The usual depth of tone and sparkle obtained in a lantern-slide must be avoided here, since delicacy and the rendering of all detail contained in the small negative are of the highest importance if we would get a perfect reproduction in the large one. A consideration of the manipulation in contact printing would be of great service in the production of the small positive, since all the chemical and physical conditions apply equally in altering the character of the negative if desirable.

Fixing and washing are carried out as usual, and,

when dry, the positive is placed in the lantern in the usual way, remembering that the *film* side must face the light if a plate is used for the large negative. The large plate should be supported in a printing frame, and focussing effected by substituting a piece of white card in its place, Should there be any difficulty in focussing, the following is a good method of obtaining the acme of definition :—Take an ordinary dry plate, and without exposing to light place it in the fixing bath till all the silver bromide is dissolved, leaving only the clear film ; wash and dry, and then with a fine-pointed hard pencil rule a number of parallel lines both ways of the plate at about one-sixteenth of an inch apart This plate is placed in the lantern and accurately focussed, after which the positive to be enlarged is substituted.

Now, if a considerable amount of work in this direction is contemplated, with the use of plates for the enlarged image, the question of trial exposures is rather a serious matter from the economical point of view, and I would strongly recommend workers to make a few experiments in order to facilitate the process as much as possible. To this end a comparison of the relative speeds of a certain brand of bromide paper and a certain brand of plate should be made ; the paper should be as thin and smooth as possible, but should not have a glazed surface. Here, then, we may use bromide paper for the trial exposure and reduce the exposure for the plate to the corresponding degree. As a matter of fact, from an artistic point of view, for a negative 10 in.×8 in. and upwards, the use of plates is totally unnecessary ; negative paper, and bromide paper oiled or waxed, giving everything that could be desired in the form of a negative for contact printing, there being little or no indication of the grain of the paper. The subsequent

operations in the process are identical with those given for direct enlargements.

In the second method, an enlarged positive is made direct from the original negative, and the negative made by contact from that. Although not quite so economical for the inexperienced worker, this method has a great feature in the facility with which any retouching may be executed, especially when paper is used, as the effect and value of each pencil or brush stroke are immediately seen.

If thin bromide paper is used for the enlarged negative, the grain is so fine that there is really no need to try and eliminate it by oiling or waxing; if, however, it is desired to increase the translucency, the following methods may be employed :—Take some castor oil and apply to the back of the print with a piece of rag. Place the print between clean blotting paper, and apply a warm iron to the back, changing the blotting-paper so long as it absorbs oil, until the print has become uniformly translucent. The operation is extremely easy, and any kind of bromide paper will answer. If wax is preferred, then paraffin wax may be employed.

A convenient way of using it is to melt the wax and pour it on a piece of ordinary paper, or to dip the paper in the molten wax, and then, placing the bromide print face downwards on a clean piece of blotting-paper, put the waxed paper on the back of it; cover with a piece or two of blotting-paper and apply a hot iron.

CONTACT PRINTING.

The manipulations in the process of contact printing with bromide paper are precisely similar to those given in enlarging, with perhaps a few modifications in exposure and development. There is, however one great advantageous feature which this developing printing

process has over other contact methods, rendering it almost independent of the quality of the negative—that of variation and control of the actinicity of the printing light.

It is well known that in ordinary silver printing a pyro-developed negative generally yields a finer print than one which has been made with a non-staining developer. The reason of this is simply that the slight yellow stain produced by the pyro restrains the power of the blue rays, which is one of the primary colours, and the most active of which white light is composed. It follows, then, that if a negative developed with a non-staining developer be printed behind a pale yellow glass, practically the same effect is produced. Also, and inversely, if we print a pyro-stained negative behind a pale-blue glass we get practically the same conditions. Again, a negative printed from in sunlight will produce a much flatter print than if it had been printed in shade. Now bromide contact printing by daylight is prohibited by the rapidity of the paper, but the above chemical and physical considerations may be applied to artificial light, and practically they are as follows :—

A dense negative should be printed quickly by a light of high actinicity, and the actinicity may be increased by the interposition of a pale-blue glass.

A thin negative should be printed slowly by a light of low actinicity, and the actinicity may be restrained by the interposition of a pale-yellow glass.

Control over the scale of gradation is obtained by varying the distance between the printing light and the negative.

To carry out the manipulations successfully, method and system are essential.

To this end, the use of a printing board or similar apparatus is advisable.

This is simply a graduated board with a burner fixed at one end and a movable support for the printing-frame at the other.

The graduations are made at standard distances, the value of the light at each point being known. These values are calculated from the law of the intensity of light mentioned previously. As an example I have given the values up to one-tenth, and as the scale should not be less than six feet the worker should make it complete up to whatever length he adopts.

Printing should never be carried out with a naked flame, but a diffuser of tissue paper, ground glass, or opal, should be placed in front of the burner as shown.

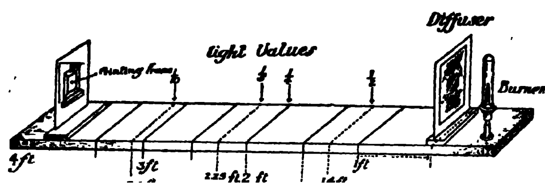


FIG. 15.—Printing Boards.

The scale may, of course, be marked out on a table or similar convenient apparatus, but the burner, or source of illumination, should be a fixed point.

Do not expose at less than a distance of one foot, as even with a diffuser there is a danger of getting uneven lighting. Experiments should be made with a certain negative to ascertain the effect of varying the printing distance and the use of blue and yellow glasses. I believe there is no better printing light than the incandescent mantle, any evil effects due to reduction of intensity from constant use being overcome by a trial exposure, which should be made in any case. This trial exposure is carried out in the manner already described, except that the shield is placed outside the

frame, or there is a special printing-frame sold expressly for the purpose.

Development.—The same process for development as in enlarging may be employed, but when a large number of prints have to be made a more rapid method is advisable, but an accurate determination of the exposure is very essential. The method consists in using a large volume of developer of normal or nearly normal strength, and adding to it from time to time if necessary. Prints up to whole-plate size should not be previously soaked, but pushed quickly under the developer, the volume being sufficient to allow of this manipulation being carried out successfully. If prints have to be controlled or developed only to a certain degree, the developer must be sufficiently weak to allow of their being removed to the fixing bath without any possibility of over-development.

Combination printing in contact work is rather more restricted than in enlarging. The manipulations may be carried out in the same way, but with this difference, that the glass side of the negative is made to take the place of the screen. Thus, the second negative is placed in the printing frame with the *film side* facing the light, and if the "wet print" method be adopted the print is placed in contact with the glass side of the negative.

Where the "way" of the image will allow, the emulsion side of the print is in contact with the glass; if not, then the paper side of the print must be used. This involves slight diffusion and the exposure increased by about six times, but if the negative be varnished this necessity is obviated.

GASLIGHT PAPER.

This paper, although not strictly speaking a Bromide paper, may be conveniently included here, as it is treated in much the same way, with the two exceptions that its

slowness—which is about one-tenth that of rapid bromide—allows of daylight exposure if desired, and that development should be rapid.

Its slowness is its only advantage over bromide paper, unless it may be that the tiro is enabled to obtain deeper blacks. The scale of gradation is rather shorter.

It is possible to develop it in subdued gaslight, in which case the light should be at the back of the operator; but it is decidedly better to develop it in a light given by an incandescent burner behind one thickness of Canary Fabric or Bookbinder's Cloth.

Intensification, toning, etc., may be applied just as with bromide paper.

The ease and facility with which this paper is manipulated is a very great feature; almost any kind of negative may be employed, except very thin ones; these do not give quite such satisfactory prints as those, for instance, used for "P.O.P." carbon and platinum.

If a large number of prints are to be made it is advisable to use a fairly large volume of developer and push each print under the solution face up.

The strength of the developer may be semi-normal or quite normal, and, as the latitude of exposure is great, accurately-timed exposures are not so essential, as a difference of five per cent. in the time makes no apparent difference.

Transfer the prints direct from the developer to the fixing bath, which may be of the same strength as that given for bromide paper, but care must be taken to get a complete flow of the fixing solution over the print at first. Fixing occupies about five minutes. Wash for one hour in running water and do not allow the print to stick together either during washing or any other operation.

SOME BROMIDE VARIETIES.

Glossy Bromide and Bromide Cards.—Glossy bromide paper requires slightly different treatment from the ordinary.

It is not so amenable to weak development. Either a developer of normal or semi-normal strength should be employed, and of sufficient volume to allow of the print being pushed under the developer without previous soaking in water.

Streaks and markings very often appear during development, but these are merely due to slight abrasions of the surface, and are easily removed from the dry print by rubbing with a tuft of cotton-wool soaked with alcohol or methylated spirit.

Card Bromide.—This is a very fine institution, inasmuch as prints made on it require no mounting; thus, of a margin be left round the image, or a border of some kind printed at the time of exposing the emulsion, a very effective and finished print is obtained

The thickness and opacity of the card prevents any loss of intensity in the image from translucency, and an exquisite transparent depth is thereby obtained

Development may be carried out in precisely the same way as with ordinary brands of paper, but it is preferable not to soak the prints before development.

Although chiefly used for post-cards, large prints are equally effective, and the convenience of having a stiff material to manipulate is not to be underestimated.

Personally, I prefer post-cards of this kind to ordinary gaslight cards, as the range of tones is infinitely greater.

In conclusion, I would remind workers that all bromide prints should receive a final cleaning by rubbing them with a tuft of cotton wool soaked in alcohol after they are mounted, and, if after this they are vigorously polished with a silk handkerchief, using considerable

pressure, they will take on a fine lustre without being glossy.

Lustra Matt.—Since the above was written a new brand of Barnet bromide paper, called Lustra Matt, has been introduced. Personally, I cannot speak too highly of this innovation, which is a great advance in bromide paper manufacture. Here, the great objection to matt surface papers—clogging of deep shadows—is entirely absent, and, with an apparently thick emulsion, we get a liquidness of shadow depth almost equal to that of the "ordinary" brand. At the same time the matt surface is perfectly retained, there being absolutely no gloss. I cannot help saying that it is quite time such a paper was put before the photographic public, as it has been a long-felt want. It is manipulated in precisely the same manner as other brands.

C. Winthrope Somerville.





Carbon Printing.



ARBON printing being so essentially different in its methods from other processes, the terms used to describe the various operations also differ widely, so that to the ordinary worker it may appear forbiddingly strange and difficult.

Strange it is, to an extent, but certainly not difficult to any careful and systematic worker ; and as soon as the initial points are mastered, it becomes the most flexible and adaptable, as well as the most fascinating of printing processes. And the initial difficulties are less than in many other printing methods. There is no reason why a first essay in carbon should not result in fair prints if reasonable care is exercised.

The object of this article is mainly to describe the working of the process in detail in such a manner that those unacquainted with it may, from these pages alone, derive all the information that they require to become successful carbon printers, the probable causes of failure or defective results being given, as well as the simple description of the most direct method of ensuring success. In addition, it is hoped that gleanings from the author's experience in working the process may be useful to many who have long passed the preliminary stages of the work, as they are original methods of arriving at the result desired, departures from ordinary practice that have

appeared to be improvements when regarded from the point of view of the worker on a small scale.

Carbon is essentially the process for the amateur photographer, as by its aid so much variety in the resulting prints may be secured without any variation in working, or equally, if desired, any number of prints absolutely identical in tone or colour; whether the colour desired be black, brown, red, or even green or blue. And a most important consideration for the worker who wishes his prints to be as close as possible in their approach to the depth and effect that he has determined upon, is that the exact depth can be determined in development in full daylight when there is no further operation to modify the effect that has been produced. There is a fair latitude possible in development, quite sufficient to cover the errors of exposure within the limits of reasonable care in working. And before proceeding to the practical consideration of the work, attention may be called to the fact that carbon differs from all other printing methods in a manner that most workers will appreciate. However the print may have to be treated to compensate for error in exposure or to obtain any special effect by developing one portion more than another, the colour is unaffected. It remains the exact shade determined upon when the sensitive paper was placed in the printing frame.

Carbon tissue, as the paper bearing the gelatine film is called, may be purchased from the makers either sensitive or insensitive. The inexperienced worker should obtain sensitive tissue, though as he becomes more advanced he will certainly prefer to sensitise tissue as required for printing, this course offering so many advantages. But at first it is necessary to reduce the chances of failure to the minimum, and in purchasing sensitive tissue the beginner can ensure that his materials

are in a condition that renders the finest result possible. If he should fail, the reason is not in his materials but in his working.

Carbon tissue consists simply of a film of coloured gelatine supported on paper, similar in some respects to the film in gelatine silver printing papers ; but in place of the sensitive silver salt in the latter, the former is rendered sensitive to light by containing potassium bichromate ; and instead of being white like the silver paper it is very dark, the actual surface appearance being that of the deepest shadow of the final print.

The basis of the carbon process is the fact that gelatine is rendered insoluble by potassium bichromate and subsequent exposure to light. In practice, a sheet of paper is coated with a film of coloured gelatine which has been rendered sensitive to the action of light by the addition of potassium bichromate, and, after exposure under a negative, those parts on which the light has not acted are dissolved away, leaving the image standing. In a description it sounds terribly clumsy and unpromising, in practice it is capable of the most delicate effects and perfect rendering of gradation, combined with the greatest force and vigour, if desired.

As gelatine is colourless, the colour of the print is determined in the manufacture of the tissue by the pigments added to the gelatine, the after-treatment, development, etc., having no effect on this colour.

The only difference between sensitive and insensitive tissue is that the former has the sensitising salt incorporated during manufacture ; the latter is exactly similar excepting in this one respect, and it has to be rendered sensitive by immersion in a sensitising bath before using.

Sensitive tissue will not keep in really good condition for more than seven to ten days, insensitive will keep

indefinitely if stored in a thoroughly dry room. In a damp atmosphere it will rapidly deteriorate.

The results are permanent. The gelatine film that remains after exposure and development is absolutely insoluble, and manufacturers are careful to select permanent colours for tissue making. With an unfading pigment and thoroughly toughened gelatine, a print is secured as lasting as anything on a paper basis can possibly be.

The tissues are made in a variety of colours, the following being those most useful for pictorial work :—

Engraving black. A good pure black, similar in tone to the black of a print from a steel plate, or closely resembling platinotype when developed in potassium oxalate.

Warm black. A warmer colour than the preceding, but inclining to a purple-black rather than brown. This colour is richest and most pleasing when a toned paper support is used.

Barnet brown. A rich deep brown, very similar to the warm brown in which most etchings are printed. This colour, even more than the preceding, is far more pleasing and rich when toned transfer paper is used.

Sepia. A pure warm brown, very similar in character to the preceding, but warmer in tone.

Warm sepia. Similar to the preceding, but still warmer.

Terra-cotta. A good red, inclining to brown, suitable or flower studies, portraits of children, etc.

Red chalk. A good pleasing red, not so crude in character as red chalk itself.

Although green, blue, purple, and other colours are made, they cannot be recommended for pictorial purposes.

Transfer paper has been mentioned in speaking of these tissues. It forms the support of the finished print, the paper on which the film is coated being removed during the after-treatment.



GULLS.
BY JOHN C. DOUGLAS

The ordinary form of "single transfer" paper is a fine white paper coated with insoluble gelatine. The prepared side is slightly glossy, and prints finished on this dry with rather glossy shadows, but the lighter shades practically matt

In commencing carbon printing it is necessary to procure some sensitive tissue; it is sold in all the usual photographic sizes, in flat packets of one dozen pieces each; and also a packet of the corresponding size of single transfer paper. This paper must be slightly larger than the tissue, but sufficient allowance is made by the manufacturers when the paper is cut.

A squeegee, some powdered alum and blotting paper will be required, but nothing else. A solution of alum should be prepared, one ounce in a pint of water, but beyond this no chemical solutions are required. The alum should be dissolved in boiling water, but the solution must be used cold.

The negative should be strong and vigorous, stronger than would give the best result in silver printing, and must be prepared by receiving what is called in carbon printing a "safe-edge." This is some means of protecting the edges of the sensitive tissue from light, so that a margin about an eighth of an inch wide prints white. This safe-edge may be a piece of lantern-slide binding attached to the negative on either the glass or film side, or a mask of opaque paper may be laid in the printing frame, or the negative may be edged with opaque water-colour by means of a ruling pen and brush. In any case the tissue must overlap the mask so that its edges are protected. If a print is being taken from a portion of a negative the cut mask is the only method to adopt. This plan has the advantage that one mask may serve for several negatives.

The carbon tissue, when received, appears most

unpromising material, resembling artificial leather-cloth more than photographic printing paper. The gelatine film is coated on a stout paper, so it may be handled freely with the same precautions that apply to other daylight printing papers. The frames should be filled in subdued daylight, the same as for silver printing; but extra care should be taken not to expose the tissue to light more than necessary. Any slight degradation of the lighter work will not fix out as in silver.

The dark side of the tissue should be placed in contact with the film of the negative, taking care that the tissue is so placed that it slightly overlaps the safe-edge all round, and the exposure made to daylight in the same manner as for silver printing.

There is no visible image produced, consequently means have to be devised for gauging the extent to which printing must be carried. The most simple plan for the beginner to adopt is to select a day when the light is fairly uniform, and taking the negative from which the carbon print is desired, take a rough print from a portion on a piece of Barnet P.O.P. If only a portion of the negative is printed it must include some of the lightest work. Expose the silver paper until its appearance is just what is desired in the finished print, not dark enough to allow for reduction in toning, and note how long a time is required to produce this result.

Barnet carbon tissue and Barnet P.O.P. are approximately equal in rapidity, and this time will be the correct exposure for the carbon print. In ordinary practice it is desirable to expose black tissue slightly less than brown, and warm brown or red slightly longer, not because of any actual difference in speed but simply on account of the fact that a black print always appears darker than the same depth of printing in brown or red.

The best time of exposure is one-sixth less than the

time of the test print for black, and one-sixth more for red, the test time being the correct exposure for brown. Although there is latitude in development, the more careful the attempt made to expose correctly, the more probable will it be that the print is within the latitude possible for securing a good result.

Although this method is suggested for preliminary attempts, it is not to be recommended for ordinary work. It possesses the distinct disadvantage that a test has to be made every time a print is required, unless the worker be fortunate enough to secure several very similar days. Printing by actinometer is very simple in practice, and in every way preferable. It will be described later.

The prints when sufficiently exposed may be transferred and developed at once. The transfer is rendered necessary by the fact that practically the whole of the surface of the film has been rendered insoluble, while the soluble portion remains at the back, and it is therefore necessary to develop from the back. Transferring is, however, such an exceedingly simple operation that it cannot be said to add any difficulty to carbon printing.

Pieces of transfer paper—one for each print—are soaked in cold water for four or five minutes until quite limp; and it is a good precaution to mark the backs in pencil before putting in water, as the inexperienced may find difficulty in determining which is the face when they are wet. A second dish should be filled with cold water, and one piece of transfer taken from the dish in which all are soaking and placed in this face upwards, and a print put in the same dish face downwards—the face of the print towards the face of the transfer paper. As soon as the print is sufficiently limp, that and the transfer paper are lifted out together, placed on a smooth hard surface, the transfer paper

underneath, and squeegeed firmly into contact. Too much force should not be used, but fairly firm strokes in each direction along the print. It is better to use a squeegee sufficiently long to cover the print, so that one stroke makes the operation uniform. A roller squeegee is useless.

The prints must be protected from daylight until they are put into the water; after this they have lost their sensitiveness to light, and all subsequent work, development, etc., may be carried out in full daylight. This assists considerably in determining the extent to which they shall be developed.

On first putting the print in water it has a tendency to curl with the sensitive side inwards, though this tendency will vary according to the dryness of the print. If it should curl it will uncurl again as the film absorbs water. and the best time for lifting it out to squeegee down is just before it becomes flat. If the tendency to curl is very slight, it should be carefully watched, and as soon as it shows the slightest sign of flattening itself, taken out. Under ordinary conditions the time necessary for immersing in water may vary from fifteen seconds to one minute, depending entirely on the dryness of the tissue. Under no circumstances must it be allowed to remain until thoroughly flat or curling outwards, the best time to take it from the water being as soon as it is sufficiently limp to allow the squeegeeing into contact to be performed satisfactorily.

As soon as the squeegeeing is done the prints are to be placed between stout blotting paper, and put under moderate pressure for about twelve to fifteen minutes to partially dry. If several prints are dried together they must be separated by pieces of blotting paper.

They should on no account be left drying much beyond this time, as there is a very decided tendency to

become insoluble. They should then be put in a dish of cold water, from which they may be taken one at a time as required for development. Soaking the prints in cold water at this stage is a departure from the usual practice, but it allows the worker to develop them singly without undue hurry. If several were left drying while others were developed, those taken last would probably be so insoluble that good results would be almost an impossibility. The cold water will not injure the prints in any way, but greatly facilitate the subsequent development. That first developed may have two or three minutes' soaking only, that taken last half an hour or more, but there will be no difference in the working or final result.

For development, hot water only is required. Those who work the carbon process largely use a specially made deep dish or developing tank, resting on supports, so that a gas ring or spirit lamp standing underneath keeps the water at a uniform temperature. For the occasional worker, however, an efficient substitute can be found in the usual household appliances. For small sizes, any moderate sized bowl will answer, provided it be nearly twice as long as the prints and at least five inches deep; for larger work, a small bath or similar appliance will answer well. The objection to a shallow dish is that the water cools so very rapidly; by keeping a body of water four or five inches deep the temperature may be maintained at a moderately uniform point.

The standard temperature for working is 105 degrees, and if carbon printing is to form part of any amateur's regular work a thermometer should be added to his photographic outfit, as it ensures uniformity in working, which, in carbon especially, is essential to success. If a thermometer is not available for preliminary trials the degree of warmth must be gauged by the hand,

though it is difficult to give more than a rough test. It should be somewhat hotter than the usual temperature for a warm bath.

The beginner should not attempt to develop more than one print at a time, and if the temperature of the water in the developing bowl is correct when a print is commenced, the slight falling off during development will not be of the slightest consequence, unless the print be over-exposed, when more hot water should be added. A small kettle of boiling water will serve to raise the temperature before commencing a fresh print. A little should be added to that already in the developing bowl; the discoloration of that that has been used is unimportant; however many prints may have been developed in it they will still emerge bright, clean, and unstained. Prints of different colours may be developed in the same water—it has absolutely no staining effect.

A print should be taken from the dish of cold water and put into the developing bath, transfer paper downwards, and kept beneath the surface of the water. After a few seconds—fifteen to forty, according to the temperature and the condition of the tissue—the colour will be seen to ooze out from the edges of the print. A corner of the backing paper should be gently lifted from the transfer paper, and if it lifts easily, gently pulled away, leaving the gelatine film on the transfer paper. If it does not come away easily it should be left a little longer, and a second attempt made from a different corner.

The backing paper should be removed with a steady even movement, and, if possible, without stopping; and it is very important that the print should be kept beneath the surface of the water during the operation. The backing paper should be thrown away, as it is absolutely worthless.

The print at this stage looks as though a passable result were a physical impossibility, as it consists of a soft semi-fluid, semi-jelly-like mass of coloured gelatine. But what is seen is the back or fully soluble portion of the film, and this semi-fluid condition is an indication of the ease with which it may be washed away.

Development is effected by simply soaking the print in the hot water. It should be lifted out from time to time, and the loosened gelatine and water allowed to run off, so that its progress can be seen; but apart from this it should be kept below the surface of the water, and water made to flow gently over it by the motion of the hand. Although the soluble portion of the film is so soft and easily removed, the insoluble part forming the image is fairly tenacious, and with the treatment suggested there should be no risk of injury. When the print is lifted from the developing bath it may be supported on the hand or a piece of glass, and some of the water flowed over it; or it may be simply drained, so that its progress can be judged, and put back again. The picture will gradually become more clearly defined as the gelatine unaffected by light dissolves away, and the operation should be continued until the print is sufficiently light, when it should be placed face downwards in a dish of cold water to rinse off any remaining solution or gelatine.

An alternative method is to simply leave the print face downwards in the developing bath, when the gelatine will flow from the surface as it is loosened by the hot water, and the print will develop automatically. It can be examined from time to time and its progress seen.

A correctly exposed print should be developed in four or five minutes.

Like all other photographic prints, it appears rather

darker after drying than while wet, and allowance for this must be made in developing.

Although the image is sufficiently tough to bear the hot treatment without injury, it must on no account be touched by the fingers or by coming into contact with the edges of the dish or other prints. It is very soft, and it is impossible to touch it without removing some portion of the gelatine, and so leaving a mark. This is a sufficiently good reason for the advice given to develop prints one at a time, when there is practically no risk of injury if reasonable care is exercised.

It will be recognised that there is no sharp dividing line between gelatine that has remained soluble and that that has been rendered insoluble, excepting on the surface; in the thickness of the film it is a gradual change from one condition to the other. Part of that remaining to form the image could be dissolved away if required.

When one print has been placed in cold water to rinse, the water in the developing bath should be raised to the initial temperature again and a second print commenced, the work being repeated until all are finished.

In the meantime, the print first developed is given a second change of water, and then placed in a dish containing some of the alum solution previously given. With care, and by using plenty of solution, several prints may be put in one dish together, but they must not be allowed to touch each other while in the solution or in being removed.

Prints should remain in the alum solution for about five minutes, then be rinsed in three or four changes of water, and hung up to dry. Small wooden clips form the most convenient method, as they can be readily suspended from a line. The prints must be allowed to dry spontaneously, and on no account must the surface be touched until they are perfectly dry.

It has been pointed out that when the film has been exposed under a negative the action of the light has been to render a certain part near the face practically insoluble, and that the condition does not change suddenly, but gradually merges into perfect solubility towards the back. It necessarily follows that there is a certain part of the film that is partially soluble only, and instead of dissolving rapidly like the perfectly soluble back, will only dissolve by prolonged treatment ; and, consequently, long development will give a lighter print than shorter, as more of this semi-soluble gelatine will be dissolved.

This fact provides a very simple means of correcting slight over or under-exposure of the print. If the print has been exposed too long a time in the frame and normal development would leave it somewhat dark, longer treatment in the developing bath will so far reduce it that it will be indistinguishable from one correctly exposed.

If the exposure has been too short the print should be removed from the bath as quickly as possible and placed in cold water. Development should be continued in water considerably cooler than usual—as cool, in fact, as will produce any action. Should this fail to remove sufficient of the gelatine the temperature of the water may be gradually raised until the print is sufficiently light.

If the print is much under-exposed there is no possibility of obtaining a satisfactory result.

If it is much over-exposed, the longer development will not reduce it sufficiently, as a point soon arrives when the degree of insolubility is too great for the normal temperature to soften. By raising the temperature, however, greater solvent power is exercised, and under all ordinary circumstances this should prove a sufficient remedy and ensure good prints. It is not

desirable to raise the temperature beyond 120 or 125 degrees at most, and this should only be resorted to when a lesser degree of warmth—115, for example—has failed.

Development may be prolonged even in this hot water, but the risk of injury to the print is considerably increased.

This description has been kept as simple in character as possible in order to enable those commencing carbon printing to carry their first prints through the various stages successfully without the necessity of having to study more than those points absolutely essential for preliminary work.

In order to become thoroughly familiar with the carbon process, however, and derive the full advantage of its many attractive features in their ordinary work, it will be necessary to give much more detailed attention to the various operations already described, as well as to others that are equally necessary if anything more than the most simple and elementary work is attempted.

Although there are no special difficulties to overcome, and nothing to render carbon printing beyond the powers of any careful worker, yet the mistake must not be made of assuming that the work is so simple and easy that there is practically nothing to learn. However simple any process may be, it requires learning by experience, and it is only by careful attention to detail at every stage that success can be assured. In the most simple work failure may easily result from want of acquaintance with essential points or want of care in working details.

To a greater extent than in most other processes does this apply to carbon. The absence of any visible image and the extremely delicate nature of the film during development render thoroughly systematic and careful

work absolutely necessary throughout. But assuming the capability of working systematically and of giving careful attention to detail, there is no reason why any amateur photographer should not adopt the process that gives more perfect satisfaction as a means of printing from negatives than any other. The variety of effect and colour possible, combined with richness and delicacy, is unsurpassed.

DEFECTS.

The defects and failures that may arise in the work already described—single transfer printing—are not many, and a knowledge of their cause will enable the worker to take precautions to prevent their occurring.

Should the backing paper refuse to strip off easily after the print has remained a minute or more in the developing dish, it indicates that the tissue has become insoluble. This may be due to keeping it too long before printing, or keeping prints too long before development, or by over-printing. The cold water bath advised before development facilitates removal of the backing paper, and also prevents another cause of insolubility from arising, keeping prints drying too long after squeegeeing to the backing paper. If the tissue is in good condition and the prints not over-exposed, from fifteen to thirty seconds should be sufficient time for the hot water to render the removal of the backing paper easy. And it is desirable to remove it as soon as possible after immersing the print, but force should never be used.

When difficulty arises in removing the backing paper, hotter water should be tried ; the degree of heat necessary for this will not be too great for developing, as it indicates partial insolubility of the gelatine right through the film.

In extreme cases the gelatine film may peel off the

transfer paper instead of the backing paper leaving the film. This can only be caused by the tissue having become thoroughly insoluble and useless.

The use of the safe-edge will be readily recognised from this description. By its aid a thin strip of tissue unacted on by light is preserved as a margin to the print, which will be perfectly soluble if the tissue is in good condition. This margin will, of necessity, be the most soluble portion of the film, and consequently, the backing paper will readily loosen itself from the transfer paper at the edges, so that it can be easily lifted and pulled away without any risk of bringing the film with it. Without the safe-edge successful removal of the backing paper would be impossible; wherever a dark shadow formed the margin of the print, the small degree of solubility of any portion of the film at that point would induce it to cling to the backing paper and loosen its hold to the transfer.

STORAGE OF TISSUE AND PRINTS.

Sensitive tissue must be kept very carefully, or it will deteriorate even more rapidly than the time previously given. It should be kept in the wrapping paper or envelope in which it is packed by the makers, or else in waxed paper, and placed under moderate pressure in a printing frame, but it is desirable to use it within seven or eight days.

If prints are not developed as soon as they are taken from the frames, they may be kept in a similar manner to the tissue, or in a calcium tube similar to that used for storing platinotype paper. If they are placed in a tube they should be rolled film inwards.

CONTINUATING ACTION.

There is a curious property in the carbon process in which it is unique among ordinary printing methods,

and that is that a print after exposure to light continues gaining in depth even if kept in absolute darkness. This continuating action is almost stopped by keeping the prints under pressure as advised, and it is entirely arrested by the preferable plan of storing them in an absolutely dry atmosphere, such as that of a calcium tube. Prints may then be kept for several hours between printing and development without the slightest loss of quality; or in extreme cases for two or three days. If kept more than a few hours the extreme dryness renders them very brittle and difficult to handle; they should be taken from the tube some time before required and allowed to absorb moisture from the air—in darkness, of course. Prints that have become dry in this manner require longer time in the cold water before they are in condition for squeegeeing to the transfer paper.

In the case of prints being taken from the frames before they are sufficiently exposed, advantage may be taken of this continuating action by leaving them exposed to the air, in darkness, when they may become similar to those fully exposed. Although expert printers find this quality an advantage in bad weather when printing is slow and difficult, it is so uncertain and beyond control that at the best it should be avoided as too unreliable for the ordinary worker.

BLISTERS AND FRILLING

Two other defects that may occur are frilling and blistering, the former being the film leaving its support at the edges during development, the latter a similar result, but in circular patches in any part of the picture.

The most usual cause is prolonged development, as the film holds to the transfer paper principally through the latter being so coated with insoluble gelatine that

water cannot penetrate from the back to loosen the film. With long development or very hot water the gelatine coating may fail to resist the penetrating action, and the film fail to hold in consequence.

There are several contributory causes, however, and these may make a print blister or frill with normal treatment, while without them it might withstand any reasonable degree of development.

Careless handling of the print during development may bend the transfer paper in places and so break the surface coating. Wherever such a break or sharp bend occurs, blisters are almost certain to appear.

Imprisonment of air between the film and transfer paper when squeegeeing into contact may frequently cause blisters during development. For this reason the water in which they are immersed for transferring should not be drawn from a tap immediately before required, but allowed to stand first.

The method of bringing the surfaces into contact is also very important. If the tissue and transfer paper are brought together under water, this cause of blistering should not exist, and in small sizes it is the most satisfactory method. In large work it is not always practicable on account of difficulty in handling, but an alternative plan is to lay the transfer paper face upwards on the squeegeeing board, well flood it with water, lift the limp tissue from the water in which it is soaking, place it face downwards on the transfer paper, and squeegee into contact.

If the tissue is allowed to soak too long before squeegeeing into contact there is a very great risk of its leaving the transfer paper either when the backing paper is being removed, or in the form of frilling during development. It should be squeegeed down before it becomes quite flat.

THE ALUM BATH.

The alum bath used after development serves two purposes. The first is the removal of a slight yellow stain due to the bichromate in the paper. With a thin transfer paper and moderate development there should be very slight yellowness to remove, and there is this difference between carbon and silver printing in this respect, that in carbon any stain due to incomplete removal of the sensitising salt is seen at the time of development, and can be removed easily. If not visible then it will never appear afterwards. The print should be kept in the alum solution until all yellow stains have disappeared, or in any case not less than four or five minutes.

The second purpose is the hardening of those semi-soluble portions of the film which have been allowed to remain to form the image, and which have now become the face of the film, and four or five minutes in the solution is sufficient for this. After drying the surface is reasonably hard.

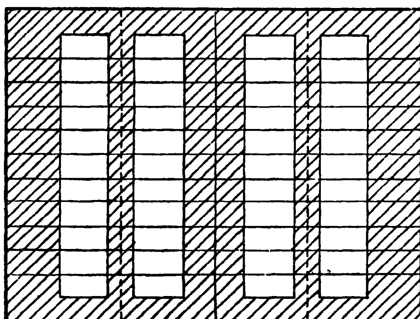
PRINTING BY ACTINOMETER.

The method suggested in the early part of this article for gauging the exposure for preliminary prints would be quite impracticable for general work. The use of an actinometer is very simple in practice, and allows prints to be exposed correctly with the minimum of trouble. In fact, when a number of frames are in use together it will be found less troublesome to refer to the actinometer from time to time and take in each frame as the exposure necessary for that particular negative is given, than to adopt the more usual method of frequently examining each print.

Actinometers of different types are articles of commerce, but making one is such an exceedingly simple

matter that probably most workers will adopt this plan.

The most simple method is to take a quarter-plate printing frame and a piece of plain glass to fit it. Some thin white tissue paper or similar paper as free from grain as possible will be required, and six or seven pieces should be cut the size of the glass. Other pieces should be cut the full length of the glass, but one being half an inch narrower, others a quarter of an inch less than the preceding in each case until the width of the glass is covered in the manner shown in the diagram, all the



widths being a quarter of an inch excepting the outside strips, which are half an inch. All these should be attached to the glass and to each other by starch, paste, or other colourless adhesive, and outside the glass ten thicknesses of the same paper should be attached at each end, extending from the end to the dotted line only, a second piece of glass being used outside these as a protection. Strips of thin opaque paper across the tissue paper where shown shaded complete the apparatus. The glasses and paper may be held together by strips of paper or lantern-slide binding.

In use, a piece of P.O.P. is placed in the frame, and



THE SEINE NET.
BY W. THOMAS.

on exposure to light the various thicknesses of tissue paper, acting as a negative consisting of squares absolutely regular in their increase of density, print squares on the P.O.P., the strips of opaque paper preserving the purity of the whites, and allowing the images of the squares to be more readily seen. First an image of the thinnest square will be faintly visible, and longer exposure will cause similar images of the other squares to appear in turn, the register for the correct exposure of any negative being the highest square that is faintly visible when that negative is correctly exposed.

The extra strips at each end of the actinometer are to obtain an extra set of squares following those given by the strips of paper first attached to the glass, the first square of the line marked corresponding in opacity to the last of the lines A. A reference letter or number marked on each square facilitates reference while printing.

It is absolutely essential in using an actinometer of this character that the same make and kind of P.O.P. should always be used for it and for making test prints from the negatives, as different makers' silver papers are not equal in rapidity.

In order to obtain the correct number on the actinometer scale for a carbon print from any negative, a rough print of that negative or from a part of it should be taken on silver paper, and the actinometer put out to print at the same time as this negative, and when the silver print has the appearance in its lighter tones that it should have when finished, as described previously for preliminary trials, reference should be made to the actinometer and the highest square visible registered as the printing number for that negative.

Several test prints may be exposed together, the actinometer being examined as each is finished.

When printing in carbon, the tissue is put in the frames, the reference number for each negative noted, and the actinometer put out with them, and by examining it from time to time each print may be brought in as the actinometer square corresponding to it becomes visible.

The exposure number obtained from the test print will be the correct one for brown tissue; black prints should be printed one number less, and red or warm brown one more.

Although this method will give approximately correct results, the difference in character between silver and carbon will sometimes make a different number desirable to obtain the best effect, but in almost all cases the exposure so obtained will enable a fair print to be obtained at the first trial, and it should be so near the best exposure that the difference can be gauged from the first print, and the number noted for all future work. This number being marked on the negative or in a notebook, will ensure all later prints from that negative being correctly exposed.

Should any negative require shielding during part of the exposure, to hold back the printing of any portion, the number on the actinometer at which the shield should be placed in position can be noted in the same manner.

Any number of frames may be put out to print by the aid of the one actinometer, provided that all are put out together. It will be seen by referring to the diagram of the actinometer that it is in duplicate. The object of this is that a piece of P.O.P. the full size of the glass may be used, and a thin opaque paper inserted in one half in front of the P.O.P. to prevent it from printing. If the actinometer is being used for several prints and some are printing very slowly, a second set of prints

may be commenced, the thin opaque paper withdrawn at the time these are put out, and the actinometer read from the second half.

DRAWING AND ETCHING PAPERS FOR SINGLE TRANSFER.

White and toned drawing and etching papers of smooth and rough surfaces are obtainable prepared for receiving prints by single transfer, in the same manner as previously described for the thin ordinary single transfer paper.

There are slight differences in working, and extra precautions are necessary to avoid failures and defects, but their use involves no special difficulty.

In order to retain the effect of the surface of the paper in the finished print, the gelatine coating is thin, and not kept so much on the surface as in the ordinary paper. Should any difficulty be experienced in determining which is the prepared surface, the paper should be held obliquely to the light, and the prepared face will appear very slightly glossy, while the back will be absolutely dull.

Prints finished on these papers will have just sufficient glaze in the shadows to assist detail and give depth, while all the lighter tones remain perfectly matt; and they retain the texture of the paper admirably.

Much longer soaking of these papers is necessary before squeegeeing the exposed prints into contact, from fifteen to forty-five minutes according to the thickness and roughness of the paper, but longer will not injure them nor affect the after working.

In squeegeeing, greater pressure must be used than is necessary with the thin smooth papers in order to ensure that the tissue shall be in good contact with the paper throughout.

In developing, blisters and frilling are more probable if the operation is prolonged, and, speaking generally, greater care is required.

In the alum bath much longer time is necessary in order to remove the yellow stain from the bichromate. With very thick papers from twenty to thirty minutes should be allowed; it will not injure the prints.

Any worker may prepare drawing or similar paper for single transfer with very little trouble. A solution of gelatine should be made, containing an ounce of good colourless hard gelatine in a pint of water. The gelatine should be soaked in cold water for about an hour, the water drained off, and sufficient boiling water added to make a pint of solution. This should be kept hot during the operation of coating the paper. As soon as the gelatine is perfectly dissolved, twenty grains of chrome alum dissolved in two ounces of hot water should be added, a little at a time, with frequent stirring or shaking. Only sufficient of the gelatine should have chrome alum added to give one coating to the paper, the addition being made for subsequent coatings when they are to be applied. A pint of solution should be sufficient for one coating for five sheets of drawing paper, Imperial size.

The solution should be applied with a sponge or flat camel-hair brush, and care taken to give a thin and even coating, the sponge or brush being first taken in one direction over the entire surface of the paper, and then across at right angles. When the first coating is dry a second should be given, keeping it like the first, thin, and as free from streaks or uneven patches as possible. If difficulty is experienced in applying this gelatine solution, it may be made thinner, and three coatings given instead of two. Or, as an alternative method, the paper may be prepared in the same manner with

plain gelatine, without the addition of chrome alum; and, after drying and cutting up, the pieces may be immersed in a solution of chrome alum, ten grains to each ounce of water, and rinsed in three or four changes of water and dried. This paper will keep indefinitely.

DOUBLE TRANSFER.

So far the method of working considered has been that called single transfer, from the fact that the film of gelatine forming the picture is transferred from the paper on which it is prepared to a new paper basis which forms the final support of the print. This method of working involves the disadvantages that the picture is reversed, a matter of little importance in many subjects, but very serious in others.

For those subjects in which it is essential that the picture should appear in its correct relation of right and left, a second transfer is necessary.

For this purpose the print must be developed on a support that shall hold it in the same manner as the single transfer paper while it is wet, but allow it to be re-transferred to its permanent basis after development and drying.

The most simple method of working is by means of what is called "flexible temporary support," a paper very similar in general character to ordinary single transfer, but very much thicker and more heavily coated.

At least two or three hours before using, the surface must be prepared by rubbing over some waxing solution specially made for this purpose. It is readily procured with the temporary supports, and, like most photographic preparations that are only used in small quantities, more troublesome and costly to prepare than to buy. A little is poured on the face of the temporary support —the slightly glossy surface—and rubbed over the entire surface with a small piece of soft non-fluffy fabric. A second piece should be used to take off any excess, and ensure that the preparation is even and uniform, each piece being rubbed gently over the surface with a circular movement. Very little of the solution should

be left on the temporary support, but sufficient to render it slightly more glossy than before the application. It should be freely exposed to the air for two or three hours to enable the solvents of the wax to evaporate and leave an exceedingly thin coating of wax only on the surface. After waxing it may be kept indefinitely before using.

In working, this temporary support is used in exactly the same manner as ordinary single transfer paper: the print has no tendency to leave it during development, and it may be handled with the same freedom. Considerably longer time should be allowed in the alum bath than is necessary for ordinary single transfer, as the temporary support holds the bichromate stain rather tenaciously. Twenty to thirty minutes should be sufficient.

After taking the prints from the alum bath they should be rinsed in three or four changes of water, and allowed to dry before the second transfer is attempted. Drying should on no account be hurried, and if the prints are not to be transferred as soon as dry, the drying should be as slow as possible. If the prints are dried rapidly in a warm room, there is considerable risk of their leaving the temporary support spontaneously.

For the second transfer a specially-prepared paper is required, sold as "final support." It is a fine white paper of smooth surface with a thick coating of soft gelatine.

When it is required to finally transfer the prints, pieces of final support are taken slightly larger than the prints but smaller than the temporary supports, and soaked in cold water for about half an hour. The prints on the temporary supports are then soaked in water—which may be slightly warm with advantage—until thoroughly limp, about five minutes, and then one is taken and laid face upwards on the squeegeeing board, as much water as practicable being drained off. A piece of final support is taken from the cold water

and immersed in warm—temperature about eighty degrees—for a few seconds, until the surface becomes soft and yielding. It is then laid face downwards on the print and firmly, but without much force, squeegeed into contact and hung up to dry. When perfectly dry it may be readily stripped from the temporary support, bringing the image firmly attached to it, by raising one corner with a knife and pulling the two apart. No part of the image should remain on the temporary support, which should be quite clean. The temporary support should be re-waxed, and is ready for use again. A large number of prints may be developed in succession on one piece of temporary support. It must be re-waxed every time.

The surface of a print developed on flexible temporary support is very similar to that of an ordinary single transfer.

DEFECTS IN DOUBLE TRANSFER.

During development the failures and defects previously mentioned in connection with single transfer are more probable when the tissue is on the temporary support, as in addition to the causes given there are others.

The most probable is that the temporary support is not in good condition. After using several times the surface will frequently become more or less dirty, and, however carefully it may have been treated with the waxing solution, fail to hold the print sufficiently. The temporary support must never be washed, the remedy would be worse than the state it was intended to rectify. It should be carefully cleaned with turpentine and re-waxed. If it still fails to work satisfactorily, it should be discarded and a new piece substituted. After using a number of times, the coating may frequently be injured, and then satisfactory working is impossible. If the cleaning with turpentine is resorted to occasionally before re-waxing, the temporary support may be kept in good condition for a much longer time.

Using a support too soon after waxing will inevitably

result in blistering or frilling, as though the support were worn out. It is a good plan to wax all supports when the prints are taken off and put them away in a box for future use.

Failure of the print to strip from the temporary support may be due to several causes. The support may have been imperfectly waxed, and, consequently, it may hold the film too tenaciously. Or the final support may have been soaked too long in warm water and lost too much of its soft coating, and insufficient may remain to hold the film. If it is not allowed to remain in the warm water sufficiently long it fails to adhere, but this is generally seen by bright lines appearing on the print where a deep shade abruptly changes to a light tone. The gelatine coating of the final support must be thoroughly softened, but not so much as to come away on being touched.

Rigid temporary supports are sometimes used for double transfer, consisting of finely-ground opal glass. They produce prints with a matt surface in place of the slight gloss resulting from the use of the flexible paper supports. They are used in all respects similarly to the flexible supports—waxing, developing, aluming and drying—but they are rather more troublesome, as they do not hold the film so well, especially in prolonged development.

Recently two new papers have been introduced for final supports for double transfer, a fine grain white and a similar paper toned. These are used in the same manner as the final support previously described, excepting that it is absolutely essential that the flexible temporary support be employed. The fine grain of the paper is well preserved in the final appearance of the print, and it is an agreeable change from the perfect smoothness of the usual final support. The toned variety is specially useful for some colours.

PRINTS ON OPAL, SINGLE TRANSFER.

Prints may be developed on opal by single transfer, the method being exactly the same as for ordinary single

transfer on paper, no preparation of the opal being necessary.

Very finely-ground opal glass must be used, a suitable kind being supplied by the manufacturers of carbon tissue and materials. As in using opal glass for double transfer, the ground surface must be used.

DOUBLE TRANSFER PRINTS ON DRAWING PAPER.

As there are many subjects for which double transfer is a necessity on account of the reversal of the picture being inadmissible, it has been felt to be an objection that so little choice of paper as a permanent support existed in the case of double transfer—until recently only plain smooth white—in contrast to the variety of tone and texture available for single.

The fine grain white and toned final supports previously mentioned form a considerable improvement, and for many workers will probably fulfil all requirements. For those who desire the same variety as in single transfer, however, and are prepared to take a little extra trouble, the following method of obtaining prints by double transfer on any kind of paper, which has been successfully employed in the author's practice during the last three or four years, will probably appeal, as it gives the opportunity of obtaining a much greater variety than by using commercial supports.

The paper must be prepared by giving it three or four coatings of a solution of gelatine, one ounce in thirty ounces of water, in a similar manner to that described for preparing paper for single transfer; but a thicker preparation is necessary, and no chrome alum or other hardening substance should be used. Nelson's No. 1 gelatine is the most suitable, though other kinds may be substituted. The prepared paper will keep indefinitely. A pint of gelatine solution should be sufficient for giving one coating to five or six sheets of imperial size drawing-paper.

The prints must be developed on flexible temporary support, and dried before transferring, the whole

working up to the time of transferring being exactly similar to the ordinary double transfer.

When ready for transferring, a solution of gelatine must be made—half an ounce to seven or eight of water—and the prints thoroughly re-wetted and the drawing-paper final support also soaked in cold water for a few minutes. The prints may with advantage be immersed in warm water for a few minutes, but only cold must be used for the drawing-paper, on account of the solubility of the gelatine. Nelson's No. 1 gelatine is the best to use for the transferring solution, and instead of weighing out small quantities the following plan may be adopted for mixing. A quantity of gelatine is taken and soaked in cold water for ten minutes or more, and then the water is drained off as closely as possible, and the gelatine dissolved by the aid of heat in the water that it has absorbed only. The solution is measured and diluted by adding hot water until it measures three times its original volume. It must be kept as hot as possible.

A print on the temporary support is taken from the water, carefully blotted to remove as much of the adherent water as possible, and laid on the squeegeeing board, a piece of the prepared drawing-paper taken and similarly blotted off, some of the hot gelatine solution poured on to the centre of the print and rapidly spread over its entire surface, care being taken to avoid air-bubbles or uncovered patches, the drawing-paper laid face down and firmly squeegeed into contact. At least half an ounce of gelatine solution must be allowed for a whole-plate print.

When dry the print may be stripped from the temporary support in the usual manner, and retains the texture of the paper admirably. It is necessary that the gelatine preparation of the paper and that uniting the print with the paper should be hardened, and for this purpose the prints should be immersed in a solution of formaline—one part to ten or twelve of water—rinsed in several changes of water and dried. The

slight gloss left by the temporary support may be entirely removed by immersing the print in hot water for a few seconds, at any time after the formaline bath.

The temporary support acquires the texture of the paper used, but this is unimportant, as this grain entirely disappears on immersion in water.

SENSITISING TISSUE.

In order to derive the full advantage of the variety of colour, etc., possessed by the carbon process, it is really necessary that the worker should sensitise tissue for his own use just as required.

Many small workers recognise that they are at a considerable disadvantage compared with those who print on a large scale, as using four or five different colours involves the purchase of four or five dozen pieces of tissue that must either be used very quickly or wasted.

The ordinary methods of sensitising produce tissue that is distinctly inferior in all respects to that sensitised by the addition of the bichromate in the course of manufacture, and in addition, special precautions have to be taken in drying.

The author has recently introduced a method of sensitising by means of which tissue may be prepared, whenever required, fully equal in both ease of working and in the gradation and quality of the resulting prints to freshly made sensitive tissue. In regard to drying, no special precautions need be taken beyond darkening the room; unlike tissue sensitised in the usual manner, gas in the drying room has practically no effect at all.

The sensitising bath is :—

Potassium bichromate	4 dr.
Citric acid	1 dr.
Water	25 oz.
Ammonia .. ..about	3 dr.

The solution should be made with hot water, and used after cooling. The quantity of ammonia given is only approximate, sufficient should be added to change the colour of the solution from deep orange to a distinct lemon yellow.

The quantity of water may be varied if desired; the weaker the bath the greater the contrast in the prints. This strength will be best for ordinary work. The solution will keep well, and may be used several times in succession.

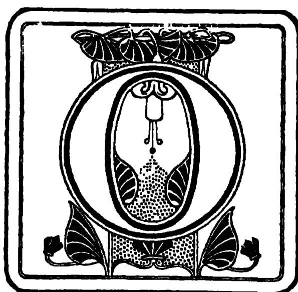
To sensitise, take a piece of tissue and immerse it in the solution, which must be as cold as possible, face downwards, taking care to avoid air-bells on both face and back. Turn the tissue over in the solution to see that there are no air-bells in the face and again turn it face down, keeping it always well covered with solution. Always immerse tissue for a uniform time in sensitising —a minute and a half is a good standard time—and as soon as the time has elapsed lift it from the solution, lay it face downwards on a sheet of glass and gently squeegee to remove as much solution as practicable. Lift the tissue carefully from the glass, pin it to a lath by two corners, and hang it up to dry in a well-ventilated room. Sensitising may be done in full daylight, but the tissue must be dried in a darkened room—not the ordinary dark-room, but one in which the light would not produce the slightest effect on ordinary silver paper. It should dry in five or six hours.

Tissue sensitised in this bath will be approximately equal in sensitiveness to Barnet ready-sensitised tisue. The best method is to sensitise at night for using the following day; but the keeping qualities are about equal to ready sensitised tissue.

Insensitive tissue will keep indefinitely if not exposed to damp; consequently a stock of all colours required may be kept and one or more pieces sensitised to suit the requirements of the moment. By this means the small worker can avail himself of the advantages of the process as fully as those who use carbon printing largely, as by the method of sensitising given it can always be ensured that the tissue is in the best possible condition when used, however little is required.

Henry W. Bennett.

Ozotype.



ZOTYPE is a modification of the carbon process designed with the object of dispensing with the actinometer and the transfer which is necessary in carbon printing to produce pictures in the correct position as to right and left. There is a distinctly visible image. The picture is produced upon the paper which forms its support in the correct position as to right and left. No safe edge is required. The pigment plaster (which is a modification of carbon tissue) is not rendered sensitive to light, and therefore keeps indefinitely.

The hands do not come into contact with a bichromate salt as in carbon printing, and the materials are not affected by extremes of temperature. No blisters are formed.

Although ready-sensitised papers are supplied by the inventor of Ozotype for the convenience of home and continental consumers, it is advisable in the case of colonial and Indian workers to sensitise the sized papers specially prepared for Ozotype.

SENSITIZING THE PAPER.

This operation may be performed in diffused daylight, but it is absolutely necessary that the drying be carried out in the dark. The tools required are very simple.

A yard of fine flannel, some cotton wool, a few yards of soft muslin, drawing or dark-room pins, sensitising solution, gum solution (one part to three of water) or fish glue solution (one in four).

A sheet of sized paper supplied by the Ozotype Company measures 30 in. by 15 in. This area requires two drachms of the sensitising solution. Lay the paper on a larger sheet of any clean paper, and pin the four corners down with drawing or dark-room pins.

Take about a square foot of the flannel and as much of the cotton wool as can be conveniently grasped in the hand. Wrap the flannel round the cotton wool so as to form a rubbing-pad.

Pour into a graduated measure exactly 120 minims or two drachms of the sensitising solution. Add to this about four to eight drops of gum or fish glue solution. Hold the glass of sensitising solution in your left hand and in your right hand have the coating pad ready.

Throw the contents of the measure on to the middle of the paper, and without losing any time spread the pool all over the surface of the paper by means of the coating pad with a circular motion until the paper is quite covered. Then with vertical and horizontal strokes increasing in lightness the paper should be evenly coated. Any remaining streaks can be obliterated by lightly passing a piece of the soft muslin across them. Hang the coated paper in a well-ventilated dark-room to dry, which will take about fifteen minutes. Cut the paper into the required sizes in gaslight (not diffused daylight), with a long pair of scissors. When dry the paper is ready for printing.

PRINTING THE INITIAL IMAGE

Any good negative is suitable. Expose to daylight until the details in the high-lights are very faintly

visible. The duration of the printing is the same as for platinotype—that is, about one-third the time required for P.O.P. printing.

WASHING THE INITIAL IMAGE.

The print should be washed as soon as possible after exposure. The extent of washing is a very important point. It should be carried out in cold running water, and should not be continued after the margins covered by the rebate of the printing frame are quite clean and white. The temperature of the washing water has an important influence upon the extent of washing. In summer when the temperature of water is from 65° to 75° Fahr., the margins of the print should be quite clean in four to six minutes. In winter time, however, with water at 35° to 40° Fahr. the washing will probably take fifteen to twenty-five minutes. In spring and autumn six to ten minutes will probably be sufficient.

PIGMENTING THE INITIAL PRINT

This operation can be carried out while the print is wet from the washing water, or the print may be dried and the pigmenting operation deferred to any convenient time within a fortnight or three weeks if the dried print is preserved in a dark place free from damp. The pigmenting operation consists in soaking a piece of pigment plaster for a short time in a very dilute solution of an acid and a reducing agent, and bringing it in contact with the print.

Make up a stock solution as under :—

Water	20 ounces
Powdered alum	1 ounce
Pure sulphuric acid	3 drachms or 180 minims

This will keep indefinitely, and the bottle should be labelled S.A. (stock acid).

For use make up one of the following solutions :—

	A	B	C
	for soft effects	for medium effects	for strong and bold effects
Water	40 oz.	40 oz.	40 oz.
S.A. solution	4 drams	6 drams	8 to 10 drams
Pure ferrous sulphate ..	1 dram	1 dram	1 dram

A is suitable for prints from contrast negatives and for delicate effects for small work on well-sized paper.
B is suitable for prints from any good negative
C is suitable for large work where boldness and strength of colour are required and for prints from weak negatives.

N.B.—The larger the proportion of S.A. solution the stronger and bolder the effect.

Another variation of the acid-reducing is given at the end of this article. The ferrous sulphate bath, however, has the advantage of rapidity in action, the picture being ready for development in about half an hour after pigmenting without any preliminary cold-water bath.

Pour the acid solution into a porcelain dish a size or two larger than the print to be pigmented. Place another dish alongside of this containing tepid water.

Take the pigment plaster and immerse it face downwards under the surface of the acid bath and begin to count 30 seconds (40 seconds in very cold weather). In the meantime take the print and draw it face and back along the surface of the water, removing all air-bells with the finger. At the expiration of about 20 seconds turn the plaster face upwards in the acid bath, and when the 30 or 40 seconds are up, place the print (which may be conveniently held in the hand after the dip in the water) face downwards, on the surface of the acid bath and draw it gently across the surface; lifting it right out of the dish. Immediately replace it in the bath, and grasping the underlying plaster by the two top

corners and holding the print by the thumbs bring the two pieces, clinging together, out of the bath and squeegee them gently together, plaster uppermost, upon some smooth non-absorbent surface such as a papier-maché board or sheet of glass. Then insert the plastered print between clean blotting-paper, passing the hand heavily over the outside of the blotting-pad. It is most important that the print should not be kept in the acid bath a moment longer than is absolutely necessary. The operation of bringing the print into contact with the plaster can be easily performed in 10 seconds, and should not occupy a much longer time. The plastered print is ready for development in 30 to 40 minutes.

DEVELOPMENT.

When the ferrous sulphate bath is used the development should take place in 30 to 45 minutes after squeegeeing. This operation is carried out in a similar manner to carbon printing. An iron tank with gas or spirit burner may be used, or hot water from a kettle may be poured into a dish. The temperature of the development water should be from 110° to 115° Fahr. for the removal of the plaster backing. Place the plastered print in the hot water and wait for about a minute. Try by a sliding movement of the thumb and finger at the four corners if the gelatine is sufficiently soft to allow of the easy separation of the paper. Do not begin to strip until this is the case, leave it a little longer if necessary. Strip the plaster backing off from one corner with a steady unbroken pull, always keeping it under the surface of the water. After the removal of the plaster the print is still covered over with pigmented gelatine, and with further treatment with hot water the picture develops more clearly, and can be allowed to remain floating on the surface of the bath, or the development can be accelerated by holding it against a sheet of zinc

(the size of the paper) and moving it up and down under the surface of the water. A small tin mug will be found useful for clearing high-lights by gently pouring the warm water over the plaster. Of course the temperature of the water can be raised for overprinted pictures. Should the development be still difficult it is a good plan to place the picture for a few minutes in a bath consisting of

Warm water	40 oz.
Hydrochloric acid	1 drachm

and continuing the development in the warm water.

The Ozotype picture is softer than the ordinary carbon print during development, and sticks more firmly to the support, so that retouching with a brush is an easy matter. Clouds can be easily made and lights emphasised with a touch of a soft camel-hair brush during development. Shadows can also be accentuated by painting them over with methylated spirit in the early stage of development.

An acid reducing bath containing acetic acid and hydroquinone has proved very successful in some hands.

	For bold effects	Medium.	Softness and delicacy
Water	40 oz.	40 oz.	40 oz.
Glacial acetic acid ..	80 minims	60 minims	40 minims
Hydroquinone	15 grains	15 grains	15 grains
10% sulphate of copper		60 minims	90 minims

In using the hydroquinone bath the following points should be attended to :—(1) The printing out should not be carried quite so far as when the iron bath is used. (2) After squeegeeing, the plaster and print should be kept a longer time in contact, say 1½ hours or any time after the print is dry. (3) Before development the plastered print must be immersed in cold water for half to one hour.

Thomas Manly.

Some Useful Formulæ.

DEVELOPERS FOR BARNET PLATES AND PAPERS.

Pyro-Soda Developer for Plates or Films.

Solution A

Pyro stock :—

Potassium metabisulphite ..	100 grains
Dissolve in water, then add pyro	1 ounce
Potassium bromide	60 grains

Shake till dissolved, and make up to measure eight ounces with water.

No. 1 Solution.

Developer :—

Pyro stock, Solution A	2 ounces
Water	18 ,,

No. 2 Solution.

Sodium carbonate crystals ..	2 ounces
Sodium sulphite	2½ ,,
Water to make	20 ,,

For use take equal parts Nos. 1 and 2

If preferred, the potassium bromide can be omitted.

Metol Developer, Single Solution.

Metol	75 grains
Water	20 ounces

When dissolved add—

Sodium sulphite	1¾ ounces
Sodium carbonate	1¾ ,,
Potassium bromide	6 grains

The quantity of water in the above may be increased to 30 ounces should the developer act too rapidly.

Other developers especially suitable for Barnet plates will be found in the article on Negative-making.

Metol Developer for Barnet Bromide Paper.

No. 1 Solution.

Water	20 ounces
Metol	100 grains
Sodium sulphite	2 ounces
Potassium bromide	12 grains

No. 2 Solution.

Water	20 ounces
Potassium carbonate	2 "

For use take three parts of No. 1 solution and one part of No. 2 solution.

Developer for Barnet Gaslight Papers.

Water	10 ounces
Metol	8 grains
Hydroquinone	30 "
Sodium sulphite	350 "
Sodium carbonate	300 "
Potassium bromide	3 "

REDUCERS FOR BROMIDE PAPER.

Thiocarbamide.

Thiocarbamide	20 grains
Citric acid	10 "
Water	10 ounces

Iodine and Cyanide.

Potassium iodide	50 grains
Iodine	30 "
Water	1 ounce
Dissolve and add potassium cyanide	10 grains

If this works too quickly it may be diluted with water. Care must be taken when using this solution, as it is very poisonous.

DEVELOPERS FOR LANTERN PLATES.

Barnet Developer for Cold Black Tones (No. 1 Formula, Metol).

A Solution.

Metol	100 grains
Sodium sulphite	2 ounces
Water	20 "



THE MIMRAM STREAM, HERTS
By HUBERT J. ELLIOTT

Taken on a Barnet Extra Rapid Plate

B Solution

Potassium carbonate	3,000 grains
Ammonium bromide	60 „
Potassium bromide	120 „
Water	20 ounces

For use take equal parts A and B.

BARNET DEVELOPER FOR COLD BLACK TONES (No. 2 FORMULA, HYDROQUINONE).

A Solution

Hydroquinone	160 grains
Sodium sulphite	2 ounces
Potassium bromide	30 grains
Water	20 ounces

B Solution.

Sodium hydrate	160 grains
Water	20 ounces

For use take equal parts Nos. A and B.

Brown tones can be obtained by taking equal parts of A and B solutions (formula No. 2), and adding to each ounce 3 grains ammonium carbonate and 3 grains ammonium bromide. Red tones can be obtained by taking equal parts of A and B solutions (formula No. 2), and adding to each ounce 6 grains ammonium carbonate and 6 grains ammonium bromide.

BARNET DEVELOPER FOR WARM SEPIA TONES (No. 3 FORMULA, PYRO).

A Solution.

Pyro	110 grains
Sodium sulphite	1 ounce
Water	20 ounces

B Solution.

Ammonium carbonate	225 grains
Potassium carbonate	188 „
Potassium hydrate	188 „
Ammonium bromide	150 „
Water	20 ounces

For use take equal parts of A and B.

TONING BATH FOR P.O.P. AND BROMIDE PAPERS.

In addition to the usual toning baths issued with each packet of paper, the following is a bath very strongly recommended :—

Sodium acetate	1 ounce
Water	16 ounces
Gold chloride	2 grains

This will tone about thirty cabinet prints.

COPPER TONING BATH FOR BROMIDE OR GASLIGHT PAPER.

A Solution.

Copper sulphate	30 grains
Potassium citrate (neutral) ..	120 ,,
Water	10 ounces

B Solution.

Potassium ferricyanide	25 grains
Potassium citrate (neutral) ..	120 ,,
Water	10 ounces

For use immerse the well-washed and fixed print in equal parts of A and B.

BLAKE SMITH'S METHOD.

A Solution.

Potassium iodide	110 grains
Water	10 ounces
Dissolve, and add iodine	45 grains

B Solution.

Sodium sulphite	1 ounce
Water	4 ounces

C Solution.

Pure sodium sulphide	1½ ounces
Water	10 ,,

Boil in a glass flask for five minutes, stirring all the time with a glass rod, and when cold filter.

For use soak a fixed and well-washed print in A solution for five minutes or until it changes to a dark blue-black both back and front. Then soak in B solution 1 dram, water 1 ounce, till all the colour has disappeared, then place in C solution 1 ounce, water 20 ounces, when the print will develop out to a very rich

sepia. (The print must remain in this solution for one minute after all action has ceased). Prints to be toned by this method should be fixed in the hypo and alum bath given on pages 276 and 277.

Hypo and Alum Method.

Immerse a rather dark print in an alum hardening bath for ten minutes, then place in the following solution :—

Hot water	70 ounces
Hypo	10 „
Dissolve, and add powdered alum	2 „

Stand to cool, but do not filter. Leave the print in this bath for ten minutes, then heat the solution to 120° or 130° Fahr., and maintain at this temperature till print is toned.

LIGHT FILTER.

Yellow Screens for Orthochromatic Plates.

For general landscape work fix an ordinary lantern plate, wash and dry it, and then soak it for one minute in :—

Naphthol yellow dye	30 grains
Water	10 ounces

Rinse it in clean water, and dry.

A STRIPPING FILM.

To Strip the Film from a Negative for Carbon Printing.

A Solution.

Methylated spirit	1 ounce
Water	1 „
Formalin	¾ „

B Solution

A solution	8 drachms
Hydrofluoric acid	¼ drachm

Cut through the film of the negative all round about ⅛ inch and place on a flat bench, and pour on to it just enough of B to cover it, letting it remain until the film appears quite loose; remove the strips all round.

Now pour on about ½ ounce of A solution and gently spread all over; lay a piece of clean white paper on negative and gently squeeze down. The paper can now be carefully removed; carry the film with it. Now place the paper film side up on to a piece of glass and pour on another ½ ounce of A solution, and squeeze another piece of paper on to it. Now remove the first paper by gently pulling it, when the film well be left on the second paper. Now pour again on to the film another ½ ounce of A solution, and place the film side down on to a piece of clean glass, and squeeze well and carefully. Now raise one corner of the paper and gently pull it off, leaving the film on the glass, but reversed for carbon printing.

The following approved formulæ, gathered from various sources, are here given, that the reader may have them ready for reference:—

ACID FIXING BATH FOR PLATES.

odium hyposulphite	4 ounces
Sodium sulphite	1 ounce
Water	16 ounces

When dissolved add 30 drops of sulphuric acid. If preferred, citric acid may be substituted for sulphuric, in which case dissolve ½ ounce citric acid in 4 ounces water and add the whole to the solution of hypo and sodium sulphite. For bromide paper dilute the above with 24 ounces of water.

FIXING AND HARDENING BATH COMBINED FOR PLATES OR FILM.

In some circumstances, as, for instance, in warm weather, it may be convenient to combine hardening effect with the fixing bath. The simplest formula is as follows:—

Common alum	1 ounce
Water	40 ounces

When dissolved, add—

Sodium sulphite	1 ounce

When this is dissolved, add—

Sodium hyposulphite	8 ounces

For bromide paper dilute the above with 40 ounces water.

Barnet Alum Hardening Bath for Plates and Papers.

Alum	1 ounce
Water	20 ounces

Soak and well wash negative or print for ten minutes.

NEGATIVE VARNISHES

Varnish for Negatives.

Gum sandarac	2 ounces
Gum benzoin	¾ ounce
Oil of lavender	½ „
Methylated spirit	20 ounces

When dissolved, filter. The negative is to be warmed before applying the varnish and then heated strongly.

Cold Negative Varnish.

Orange shellac	2 ounces
Sandarac	2 „
Canada balsam	60 grains
Oil of lavender	1 ounce
Methylated spirit	16 ounces

To be used cold, the plate being also cold. The varnish must dry naturally without heat.

The ordinary "japanner's gold size" diluted with refined benzine may also be used as a cold negative varnish.

Matt Varnish.

A formula giving an exceedingly fine grain is as follows :—

Sandarac (finest white)	2¾ ounces
Mastic „ „	½ ounce
Ether (spec. grav. ·725)	25 ounces
Benzole	14 „

First mix the ether and benzole and shake well, next add the two gums. When all is dissolved, filter ; now add—

Methylated chloroform	1 ounce

The quantity of the latter may be slightly increased if an excessively fine matt grain is required.

Negative Varnish for Celluloid Films.

Celluloid being soluble in strong spirit, a varnish for these must be made with strong or undiluted spirit, and must not when dry be too brittle, or when the film bends the varnish will crack. The following is recommended and can be used equally well for ordinary negatives on glass :—

White hard varnish	10 ounces
Liq. ammonia ·880	(see below)
Water	5 ounces

Only sufficient ammonia should be added to just dissolve the precipitate first formed.

RESTRAINERS IN DEVELOPMENT.

There are two groups of chemical restrainers in common use—bromides and citrates; the former are more generally employed, potassium bromide being the favourite, and a 10 per cent. solution thereof should be in every dark-room.

Bromides of potassium, ammonium or sodium may be used, but they all differ relatively in their restraining power. Thus, 98 parts of ammonium bromide are equal to 119 parts of potassium bromide, or 103 parts of sodium bromide.

The effect of the bromides is to prevent excessive density being gained in the high-lights before detail has developed in the shadows or less exposed parts.

The effect of the citrates is to check the production of detail, but to allow density to increase, and they are hence especially valuable in cases of excessive over-exposure.

The citrate of potassium, ammonium or sodium may be obtained from the chemist, and a 1 to 10 solution should be made for use, a small quantity being added to

the developer according to requirements, beginning with about two drops to the ounce.

Should a negative develop abundance of detail but refuse to increase in density, the citrate solution may be added, and the plate left in the developer for hours if necessary without its "fogging."

INTENSIFICATION.

A negative which for any reason is too thin and of too uniform a tint, giving a flat print lacking contrast and relief, is subjected to one or other of the numerous processes for intensification.

The usual method is that in which the plate is first bleached with mercury bichloride, and then treated with a reagent, which reconverts the image, blackening it and increasing its density.

Full particulars of this are given elsewhere, and it is only necessary to here add that the increased relative density of the various tones differs according to the blackening reagent employed.

According to some recently published results, the least degree of alteration is produced by potassium hydrate and the greatest by Schlippe's salt.

The plate having been bleached in bichloride of mercury, the degree of ultimate intensification secured by using the undermentioned reagents is in the order of the following list, commencing with the least powerful :—

1. Potassium hydrate (caustic potash), 2 per cent. solution.
2. Lime water.
3. Sodium sulphite, 10 per cent. solution.
4. Ammonia ·880, 20 drops to 1 ounce water.
5. Silver cyanide (silver nitrate and potassium cyanide).
6. Ammonium sulphide (1 part strong solution in 10 parts water).
7. Schlippe's salt.

This last named giving the maximum degree of intensification, it may be useful in the case of exceedingly thin negatives. The formula is :—

Water	100 parts
Schlippe's salt (sodium sulph-antimoniate)	3 „
Liquid ammonia	1 part

The bleached negative after thorough washing, is immersed in the above and finally washed.

Instead of hydrochloric acid in the mercuric chloride solution many workers prefer ammonium chloride :—

Mercuric chloride	5 parts
Ammonium chloride	5 parts
Water	100 „

Immersion for a few minutes in a bath composed of 1 ounce common table salt in 2 ounces water, or 1 ounce ammonium chloride in 10 ounces water, after bleaching and before blackening often leads to more brilliant results.

CLEARING-BATHS FOR STAINS, ETC.

CLEARING-BATH FOR USE AFTER DEVELOPMENT, ETC.

Alum	1 ounce
Water	20 ounces

When dissolved, add :—

Hydrochloric acid ..	50 to 100 drops

(Or 1 ounce citric acid may be substituted for the hydrochloric acid.)

This should remove the yellow or brown stains or discoloration which is often found after fixing a pyro-developed negative.

SILVER STAINS.

Bright metallic spots and brown or black ones due to silver may be removed by immersing the plate in a

solution of iodine in methylated spirits. Just sufficient should be added to produce a solution of medium sherry colour. Or the following formula may be preferred :—

Potassium iodide	.. ..	1 part
Water	.. . .	20 parts
Iodine (metal) sufficient to make a solution the colour of brown sherry.		

Stains Due to Ferricyanide Reducing Bath.

To remove such a stain as this the simple alum and hydrochloric clearing-bath may serve, but if not, then wash well and immerse in a 10 per cent. solution of sodium sulphite and finally wash thoroughly.

MOUNTANTS FOR PRINTS.

Starch.

A universal mountant is made as follows :—A teaspoonful of fine powdered Glenfield starch is made with very little cold water into a smooth thick batter ; next pour in a very fine slow stream of boiling or very hot water—say, from a kettle—stirring incessantly meanwhile ; presently the whole will become gelatinous, and when just so thick as to admit of the spoon standing up in it remove the whole to a cool place. When cold, the starch will be a thick jelly, and it is used in this form by first wetting with cold water the mounting brush and then applying it to the jelly-like mass, as one does with a pan of moist water-colours. This will be sufficient to spread on the back of the print. A pinch of powdered alum may be added whilst stirring. This mountant must only be used whilst fresh, and destroyed when it turns sour.

Gelatine Mountant.

Soft gelatine	.. .. ..	200 grains

Soak in 6 ounces distilled water for one hour ; dissolve

this by means of a water-bath or other evenly distributed heat, and add, a little at a time, 2½ ounces methylated spirit, stirring constantly. Allow to cool and set. Should any spirit separate out, remelt and add a little more water.

We shall now have a thick, white, firm jelly, which must be heated to a condition of solubility and so used.

Should this mountant prove too thin, the amount of gelatine may be increased from 200 to 300 grains.



Pictorial Photography.

PHOTOGRAPHIC MEANS APPLIED TO ARTISTIC EXPRESSION.

"This is the merit and distinction of Art; to be more real than reality, to be not Nature, but Nature's essence. It is the artist's function not to copy but to synthesise, to eliminate from the confusion of actuality, which is his raw material, whatever is accidental, idle, irrelevant, and select for perpetuation that only which is appropriate and immortal."



UT a few years ago it would have been necessary to apologise for introducing into a book like this a chapter on Pictorial Photography; to-day, no handbook intended to instruct and interest all classes of photographers, but chiefly the beginner, would be complete without a section devoted to what has become by far the most popular branch or application of photography. And yet, notwithstanding its popularity, a complete understanding of what it really means and how it should be practised is not common even amongst those whose whole concern in photography is with its pictorial side.

The very character of precision and prescription with which photography becomes identified during the time when we are learning the technicalities of the process tend to make the student regard any possible pictorial quality as something to be contributed by observing some formula or rules; a result to be achieved by the addition of certain ingredients. The very expression "picture-making," so common amongst us, betrays the presence of this idea as though a picture—that is,

an artistic conception—could be made or built up of so much of this and so much of that, and flavoured to taste.

We use the term pictorial instead of artistic, first, because the latter has become so misappropriated as to have lost its proper significance; and, secondly, because it evades useless controversy as to whether photography applied to the expression of a personal idea or emotion may be regarded as an art. We photographers need not clamour to be called artists nor appeal for the admission of our work into the picture galleries, for we may rest assured that, by the great natural law which secures that the fittest shall survive, when our productions are worthy they will receive appropriate recognition, and secure a status which no spurious position won by importunity and much argument could bestow.

The reader of this chapter of the BARNET BOOK is probably as undesirous of argument or discussion as I should be loth to write it. I am not concerned in making converts, my task being to endeavour to explain what constitates a pictorial photograph, and then to describe as best I can the means by which a pictorial result may be attained. I am well aware that to the artist the task of reducing that which with him seems to be purely a matter of feeling, emotion, and personal impression to anything like figures and formulæ will appear vain and even contemptible; nevertheless, it has been by such a road, first seeking the help of another until able to find an independent way of their own, that many of our leading and acknowledged workers have travelled. I do not think I shall tell the student anything that will mislead him or do him harm, but whether he turns it to good account as a means to higher things must depend upon himself.

I will turn first to landscape and general subjects, and,

in imagination bearing my reader company into the country, will ask him to consider what we do when we carry the camera into the field to " take photographs."

Some scene strikes our fancy; up goes the camera. We level it, we swing it from side to side, focus it, and there is the view on the ground glass. Now, why have we selected that particular scene? What determines our wish to portray this scene more than any other visible from this or another point of view?

Probably you have never paused to ask yourself that question; you just liked it, it pleased you, and, as you kuow your camera and lens will give you an exact copy of it in miniature, you feel sure that the reproduction will also please you; and, as you have always lived in the belief that Nature is beautiful, and truth to Nature a first principle in art, you are confident of securing a perfect picture, and congratulate pourself upon the fact that with so little trouble you can accomplish what the poor creature with pencils and paint-brushes must spend hours in achieving.

Wrong! all wrong! We photographers are so apt to forget that during the years that the art student is learning to use his tools he is acquiring certain principles, and cultivating ideas of which the photographer often enough has never dreamed. The youthful draughtsman sets himself down to draw a single tree or only one branch of the tree, a single flower, a figure, and so forth —not the whole field of view, mark you; and hence he gradually comes to always regard Nature as centred round one chief object or idea. Even if the photographer were of the same frame of mind, the very comprehensiveness of his process fails to realise this detachment of interest.

So much the better, perhaps, you will say, because you are able to secure so much more of Nature's beauty.

Ah! Now, before we go any further, I want you to read patiently the delivery of two statements which may sound like down-right heretical nonsense; nevertheless, I am going to ask you to try and believe them now unquestioned, and anon I think you will see the truth and reason of them.

First, then, Nature is *not* beautiful—that is, *not always* beautiful; I mean, of course, from an artistic standpoint; and, secondly, to copy Nature faithfully as a looking-glass does, and as the camera *usually* does, has nothing at all to do with pictorial art. I will repeat, Nature is not necessarily beautiful. Pictorial art is not a copy of Nature.

The first statement the reader will probably endorse more readily than the latter, because it must be evident to all that there are spots in Nature and aspects and conditions which are uninteresting and even repellent; but this is not all, and does not go far enough, for the point I want to lay down is that there are scenes in Nature which may please, attract, and even become famous for a certain kind of beauty, which are not in the narrowest or literal sense "picturesque." There are certain conditions and qualities in a natural sense, which I propose presently to describe, which are necessary ere that scene is suitable for pictorial treatment. Admirable and beautiful as is the music of many birds singing in the wood, it is not music in the artistic or æsthetic sense. Ordinary speech is not artistic language or poetry; there must be definite arrangement and composition, and so trees and flowers and hills and rivers falling just anyhow, as oftentimes they do in the little bit of Nature which we can include in our representation, may in a manner delight us, yet they will not when so depicted make any lasting appeal to the senses, and so it comes about that it is necessary to select carefully a point of

view from which the various objects so group themselves as to be in accordance with artistic requirements of composition, and the more so that the photographer can by so very little alter in his picture the relative positions of the various objects.

If, then, one should criticise your picture and should disapprove, it is no excuse for you to urge that it was like that in Nature, because, if at the particular time and from that particular standpoint Nature was not suitable, the scene in question should have been left alone until a more propitious moment, or for some other subject more complying. "Oh, but," say you, "I particularly wanted to photograph that scene." Very well, do so; but your photograph will be of topographical value—that is, it will depend purely on the intrinsic interest of the objects included or the locality, whereas the merit of a picture has nothing whatever to do with such particular interest, but is satisfactory in proportion to its general pleasing effect and its power of appealing to the imagination.

Composition, then, will form our first subject for consideration; but before proceeding let me try and explain the second statement, that, even though the selected scene be well composed, a mere copy of Nature does not necessarily constitute a good picture.

To begin with, Nature is one thing and Art the expression of the way in which Nature affects us is another. Hence from the same subject we get several quite different pictures by different men, alike in form perhaps, yet each differing in bringing out some particular feature more strongly than others. Hence each man's picture bears a stamp of personality, like his autograph, and makes you feel just as he felt about it. A picture in the proper sense is not just an inventory of all the things in the field of view at the time, but using those things in a particular way so as to stir up your

imagination, so that you hear the rustling of the breeze in the trees or the bubbling of the brook ; in imagination you feel the warm sunshine and soft winds, as well as see the mere representation of the one or the influence of the other ; and, mark you, this hearing and feeling is not conjured up by mental effort ; you do not say to yourself, the trees are bent, therefore the wind must have been blowing, or there is a light patch showing where the sun was shining, therefore it must have been warm ; but instantly, and without reflection, the imagination responds to the representation, and the emotions are quickened just as music may suddenly thrill one without his seeking or asking why. So, then, after Composition, we shall have to consider Imagination. And if you ask how is it possible to do this, I would remind you that art is artificial ; there are certain methods and rules which by observing at first will help you. Anon you will resort to your own methods, and lay down rules for yourself just as we all learn to write with pot-hooks and hangers, and when we have mastered the copy-book pattern straightway adopt our own way of making letters, and the pot-hooks and hangers of pictorial photography we may call Construction, and this will form our third heading.

The general principles of pictorial art are as old as civilisation ; they are not arbitrarily laid down by any particular set of teachers, rather have they been evolved out of the experience of all artists, and whatsoever process or means—pencil, camera, etching-needle or brush—be applied to pictorial or artistic expression, these same principles obtain.

COMPOSITION OR SELECTION OF SUBJECT..

The two terms used above are in photography nearly one and the same thing, because we can to so limited an extent compose or build up our subject ; we therefore

select it because it does compose well, and select a particular view point, because from that it composes better than from another.

Composition may be described as a certain symmetry of design or arrangement which the human senses demand for æsthetic enjoyment.

Curiously enough, we obey certain innate laws of composition in nearly everything we do in life. You put your clock in the *middle* of the shelf and ornaments on either side to *balance*. Placing a chief thing in the middle and the others grouped around in orderly fashion prevails in most cases, except when we deliberately depart therefrom for the sake of variety. You place your studs in the middle, and fasten your clothes, so following the same plan of symmetry on which our faces and bodies, and indeed all Nature, are planned, and that is the crude and primitive foundation of composition. If we draw a design or a representation of some particular thing, we instinctively set it in or near the middle of our paper, so much so that if in a picture or design the chief object were not near the centre, we should at once wonder why and seek if the paper were large enough to make it the centre of a new grouping; and this is the reason why gratifying or satisfying composition, such as the centrality of the chief object, is necessary in an artistic work—namely, that our sense shall be so appeased as to leave the feeling and imagination entirely undisturbed to respond to its appeal. Thus, an artist sketches in a cottage or perhaps part of a cottage, a tree or a portion of the road, a head and shoulders and leaves the rest lest other matters should distract the attention from the particular item which it is intended shall appeal to the emotions and imagination, yet just sufficient other details are put in or suggested as shall avoid the work possessing an incomplete effect.

The photographer is not so free as the artist, but, prompted by the same motive, he first in selecting his point of view naturally focusses his attention around the chief object, and so chooses it that other items which he must perforce fully include do not disturb the chief interest. Let us see how this is exemplified in the accompanying three sketches, which, let us suppose, represent photographs.

In Fig. 1 we have an example of what the photographer so often does. He finds that his lens will include both the ruined abbey and the farm-house, and both can be



FIG. 1.

done with no additional labour, and thus with an extravagance which costs him nothing he spends the material for two pictures on only one

Notice, however, that the middle of the picture lacks interest and there is no *one* principal point of attraction, the eye passing restlessly from the abbey to the house and back again, so that, should the picture by its beautiful lighting, its suggestion of atmosphere, the glory of the flowers, the whisperings of breezes, and the far-off mystery of the hills please us, our senses would not be so completely at rest to enjoy this appeal to our emotions. There is want of repose and centralisation of design.

In order to prevent this division of attention we include only the farm-house, in order to do which our lens compels us to include a great expanse of uninteresting country as in Fig. 2, and the eye naturally asks, "Why



FIG. 2.

this crowding down into one corner?" Compare the effect produced by Fig. 3, in which a considerable amount has been cut off in order that the chief object shall be



FIG. 3.

more or less central, and shall have nothing included to detract from it. The gain in point of centralisation and predominance has been attained by sacrifice of area. But the same may be sometimes won by a different

means. Thus in Fig. 4 we have an unpromising subject, in which several trees, all nearly equally important, give the eye no opportunity of centring on one central spot; but if we move away to the right and look at the trees



FIG. 4.

so that one comes behind the other, and the lane, instead of cutting across, leads as it were into the subject, we may get a pleasing group, as in Fig. 5. Consider for a



FIG. 5.

moment what would be the effect on the senses which these two different arrangements would respectively exert.

And now notice that in Fig. 5 the winding lane, like a graceful flourish at the end of a letter, seems tô help the

arrangement; and in this connection I may annunciate the principle that an object of comparatively little importance in itself may become the chief point of interest in proportion as the principal lines in the composition converge thereto. Thus in Fig. 6 the convergence of lines on a tiny gateway in middle distance makes it a point on which the attention focusses, to the ignoring of the big tree on the left. So powerful indeed are such lines, that in Fig. 7 one feels the eye, and therefore the attention involuntarily led to a central point, although there is nothing to interest us there. Evidently, then,



FIG. 6

the disposition of the chief lines in a picture is of great importance in securing good composition; and it is usually the course in such a treatise as this to dwell primarily and at considerable length on the composition of lines. I believe, however, that many a beginner in pictorial photography has experienced difficulty in reconciling the scenes he encounters with these diagrams, because, of course, there are no real lines present in Nature, but continuous series of masses; like the hummocks of turf, and tufts of grass which in Fig. 7 suggest lines, as outlines (such as hedgerows and hills) indicate one plane against another.

Take, for instance, the example of a moorland scene reproduced facing page 294 and entitled "Rain from the Hills" (though, here let me say, I am aware of its pictorial shortcomings, and merely choose it now as a convenient object-lesson). Notice that on looking at it the attention at once rests on the central mass of dark rock and the brightly lighted ground below it. This contrast of light and dark, as well as the happy arrangement of forms, secures concentration of interest, although the rocks to the left and the remote hills above and to

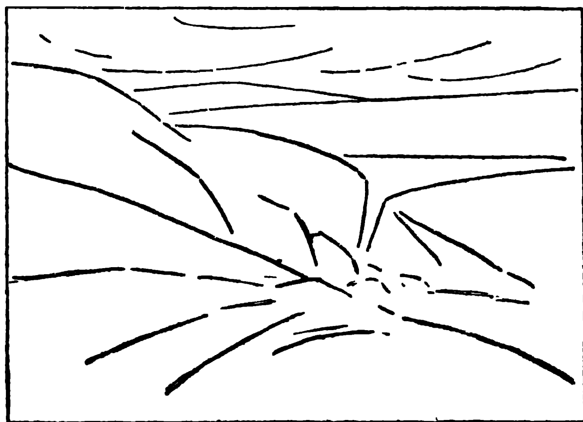


FIG. 7.

the right do not admit of one's feeling any incompleteness. Next let us resolve the composition into its *line* composition, which is seen in Fig. 8. We have already spoken of convergence of lines, and whilst this is sufficiently observed in the present example, it is also equally noteworthy that the disposition of lines is of a mutually compensating character. Suppose, for instance, a different point of view were to give an arrangement of lines as shown in Figs. 9 and 10, not at all an impossible supposition, seeing how shapes seem to change as the light shifts and changes. Surely in this case it must be

apparent that the one-sidedness of the light and shade arrangement, and the lines all sloping one way, is not so satisfying to the eye as in the former example.

But the limits of the present article forbid my dwelling longer on these points, nor am I sure that I should wish to do so, lest seeming to insist too much on a definite scheme or arrangement of lines, the beginner follows a code of rules too closely, and in so doing defeats the end which those rules seek to achieve, which is merely to suggest in a general way certain principles, compliance



with which, whilst far from securing pictorial success, may prevent the beginner from committing obvious blunders. To follow any prescribed plan of composition so closely as to betray the fact that the work has been so done, or arrange objects or so depict them that the lines of the composition are at once evident, is perhaps worse than to err on the side of unsatisfactory composition. The lines are to be only the elementary scheme or skeleton of the composition, which the tones and masses of light and shade, as well as the ideas embodied, clothe with beauty.

If the disposition of lines constitutes such a perfectly symmetrical design that it is at once recognised as being symmetrical—and this sometimes occurs even in wild



FIG. 9.

Nature—then it is wrong, because the artifice by which pleasing composition is attained is betrayed, and we feel

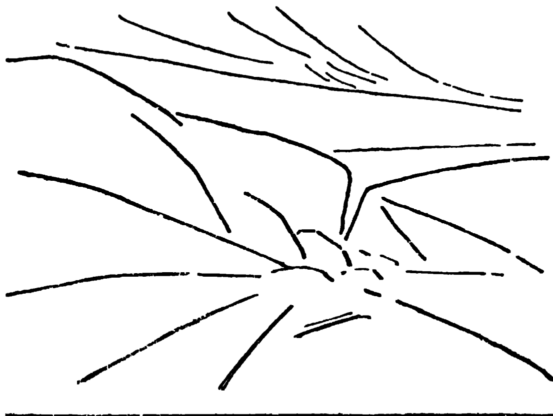


FIG. 10.

the thing to be artificial. If, on the other hand, the lines fall so as to make the beholder conscious of their presence, and wish that they were otherwise, then again they are

wrong. In neither case should lines or the arrangement of objects suggesting them be felt at all until sought for, whether they are accidental or deliberately introduced. In art it is a maxim that the means by which the thing is done should not proclaim itself. A composition should please without our quite knowing why, and without our being able to see the machinery, as it were, by which our pleasurable sensations are set in motion.

As has already been suggested, the term lines is merely a convenient form of speech, no lines existing in Nature or in the picture, a photograph consisting of tones—that is, masses of light and shade.

If, when standing before a picture we close the eyes and then suddenly open them, our first impression, apart from colour, is that of masses of light and shade harmoniously arranged; but our attention is certain to rest first and chiefly on the highest light or deepest shadow, usually the former. If we retreat to such a distance that the objects constituting those lights and shades are unrecognisable, the general balance and pleasing arrangement of light and shade should still remain. This is the quality of *breadth*, which the photographer often seems to find difficulty in understanding. Now, as the highest light and deepest dark possess the power of riveting the attention, it follows that these should be somewhere in the neighbourhood of the principal object, which, as already pointed out, will be near the centre of the composition.

With respect to breadth, let it be said that if the various shadow masses are filled with innumerable details, so as to break up into tiny lights and darks, they no longer exist as broad masses of shadow; whilst, on the other hand, if they are of such uniform depth, and so devoid of detail as to be mere empty dark spaces, we immediately feel that something has been left out. Thus

with regard to the difficult question as to how much detail and how sharp the picture should be, it may be said that *sufficient detail and sufficient sharpness* should be admitted as to avoid giving the idea that detail and definition have been sacrificed. Never forget, it is not a question of truth to the facts of Nature ; the treatment of the subject must be such that the pleasing effects of a good arrangement of parts is secured *without any obvious or flagrant sacrifice of truth.* The delineation of sharp outlines, the redundance of sharp detail, is not wrong in itself, but both are usually inexpedient when considered with respect to the effect to be produced. Similarly, the suppression of sharp focus, so often condemned because misunderstood, has no artistic merit of itself, except as it assists the picture to impress the beholder with the general effect.

The fact is, our photography is so faultlessly complete in its delineation, that it gives us more than the pictorial worker needs for the expression of his idea. A photograph may be irreproachable as an exposition of all that the process can achieve, and the subject even may be of itself beautiful, and yet merely be a good photograph of something beautiful which is not the same as being pictorial, just as we may have a fine picture which is but a poor specimen of photography.

Before leaving the subject of light and shade masses serious reference must be made to the subject of tone and the differentiation of planes, because in these two matters the beginner is commonly found to fail. They may be discussed simultaneously, being in fact inseparable. I must ask the reader to remember a general rule, which is that the further off a dark object is the less dark it appears, and the further off a white object is the less white it becomes, so that, suppose we had objects in the foreground of the picture which were black and

white, theoretically at least, there is a point somewhere in the distance at which, if the black and white objects were retired thither, they would be one and the same tone of, middle grey, or, as we commonly express it "half-tone." The relative "tone"—that is, the relative lightness and darkness of objects—depends on their distance from the observer, this alteration of tone being due to the greater or less volume of intervening atmosphere; but, as white or very light objects are comparatively rare in average landscape, the effect of atmosphere is most commonly seen upon dark objects, with the result that, generally speaking, we may say that the more distant an object the lighter or greyer it becomes.

It is the atmospheric greying of objects which contributes the valuable quality of suggesting relief or a standing out of nearer objects.

Look at an average photographic print and see how one plane seems to stick to the other; the nearest tree seems no nearer than the ones a hundred yards behind it, which in turn do not seem half a mile nearer than the belt of trees which form the skyline. Study an average landscape photograph and notice how rarely you feel that you could walk round the various objects; there is no impression of space where figures might move freely between the nearer objects and those more remote. This is because the various planes are not sufficiently differentiated by a difference of tone. On a clear day this does sometimes actually happen in Nature. You know how *near* the distance sometimes seems, which it ought not to do, but in Nature mere colour tells us something besides: we *know* the distance is distant, but the picture-maker must avail himself of this difference of tone—must make every effort to secure it in order to help the effect of his picture, which is, after all, only an artificial affair. Perhaps this may be made a little

clearer by another reference to the reproduction of the picture " Rain from the Hills," in which the furthermost hills, the hill ridge in middle distance, and the nearer group of boulders, each stand away from each other, yet all three planes are composed of similar material, rocks and heather, or the like; but in the middle distance the light-coloured fern or grass have become toned down as its rocks have become lighter, and so they form one mass of similar middle tint, the more distant hills behind being greyer and lighter still. Of course, in this case a considerable space intervenes, half a mile perhaps, but the same principle must obtain if the space between more or less remote objects is but a few yards. The effect of " standing-away-from " is not to be confused with stereoscopic effect; we do not aim at counterfeiting solidity, but merely so to render the relative tones of objects that each appears to fall back into its proper place.

Photograph any scene on a clear east-wind day, and again on a hazy day, when the distance is blue with intervening mist, and note the difference—in the latter the landscape will appear to go back; in the former, everything seems inextricably mixed up. I do not, of course, mean by this that we must only photograph on misty days, but take the comparison merely as a lesson and endeavour to import much of that quality which mist gives even when no mist is present, and thus compensate for photography's proneness to eliminate the effect of atmosphere. But this omission of atmosphere and false rendering to tone is not all photography's fault; but the practical means to be adopted to secure it I had better touch on under the third heading of Construction.

Much has now been said as to the picture conveying the artist's ideas and its appeal to the spectator's feelings

and emotions, and it is time now to turn to the rather more complex and less understood quality of a picture, which I propose to briefly deal with under the heading

IMAGINATION.

The recruit who as yet has hardly realised that a picture can be aught but a simple copy of a well-chosen scene in Nature may, if he like, leave this section for the present and pass to the next; but anon I will ask him to return to this and give it a little patient study, assuring him that the imaginative quality of his picture is as essential as the very plates and paper he uses to make it with.

We have already spoken of the desirability of the scene possessing but one more or less central chief object, the subordination of other objects, lights, and shades thereto, the convergence and balance of lines and masses, the absence of excess of irritating detail, the differentiation of planes by intervening atmosphere—all equally important, indeed essential qualities for the picture; but it will occur to the reader to say how rarely indeed will all these things happen in the same scene. Precisely, that is why it is consoling to remember that the picture is not necessarily a replica of the natural scene; that is, we may, if we can, omit or add if by so doing we can the more convincingly convey our idea. But what of this idea? Well, probably it will be simplest to say that the idea is in most cases the scene as we imagine it to be rather than as it actually is.

In photography it is not so difficult as might be supposed to produce imaginative work if only the photographer possess and will exercise his imagination. Looking at the natural scene, let him, after having chosen the point of view which seems most satisfactory, think how and in what way it might have been better, more

attractive in its arrangement, softer in its grey distance, bolder in its near contrasts. To the naturally artistic temperament this glorification of the scene which, for some reason, attracts it, is instructive.

Notice that composition is but the rearrangement of parts within or up to the limitations of the process, circumstances, or individual ability; the representation of the imagined scene is but the truthful rendering of the individual impression, the scene as the individual thought he saw it; for it must be remembered that an imaginative work must not be confused with a mere fancy picture, which may be an extravaganza. But a good imaginative work is always indistinguishable from a transcript from Nature—that is to say, on looking at it it appears so reasonable, so like Nature so true to what Nature ought to be, that none without positive knowledge could assert that it is not true to incident and fact.

The finest pictures in the world only pretend to copy Nature; reminding us of Nature by certain artifices which make us see and feel the original more vividly than would an actual copy. Fine selection or composition, accurate delineation, are but the dry bones of the noble picture which, when we confront it, thrills us by reason of something which is apart from the actual objects portrayed. This thrill, this stirring of our emotions, is, I think it may be shown, due to the imagination of the producer, who takes in the whole beauty of a scene at once; and because the lighting, the form, or some character is of a kind to which his imagination is at the time attuned, he sees in his heart and mind a more beautiful, a more perfect scene than is actually before him; and if he is successful in conveying by means of a picture this glorified impression, then he is but fulfilling the proper function of the artist,



which is to interpret Nature for others, and make others see beauties and receive ideas which they would never find in Nature for themselves.

This, I think, accounts for the selection of some particular subject which to another person may seem to have nothing especially to recommend it. Some detail, some form, some light or shadow or contrast, attracts, and instantly and quite unconsciously, the person attracted weaves as it were a halo of glory around it ; imagines it much fairer than it actually is to another person, and, as he studies it, all surrounding factors in the scene are subordinated to it and are robbed by imagination in order to emphasise and enhance it. So the painter might depict it and give us Nature as seen through his temperament. But what of the photographer ? Unconscious that the dry facts are much less beautiful than he is thinking them to be, he goes through his process of reproducing, and then anon, when the print is made how disappointing !—he is rudely awakened from his dream or more likely blames the process for its inefficiency. Is not this the story of thousands of photographs ? How often has it been said that the photograph is but a dead representation with the soul of Nature left out ? But there is no more soul in the trees and flowers and swelling hills than in that sun-made image ; the " soul " was that which the man's imagination created and *which he has taken no care to imprison.* Hence these remarks on imagination to warn the photographer that unless he take such steps or so control his process, all unsympathetic and unimaginative as it is, *how can he hope that his picture will contain what was not actually there ?*

I warned the reader that he might pass over this chapter and go to the next, for I am not prepared to say just how this imaginative quality can be imparted,

nor, I think, is anyone. It is not a thing of grains and ounces, but in the next section, after giving with the brevity which circumstances compel such outline of means and methods as I think the beginner may find useful, I shall leave him to apply them as best he may; but means and methods are of little use unless he is also awakened as to what end he is to apply them. The photographer must realise that the essence of a picture is the personal interpretation of Nature, and, having certain means placed at his disposal, he is at least more likely to be successful in their use than if he did not know to what end to employ them.

CONSTRUCTION, MEANS AND METHODS.

I have devoted more space to motive, and shall give less to actual methods than perhaps the beginner would wish, yet the apportionment which I have adopted I believe to be the best, and at least agrees with what I believe to be their relative importance. The methods which the photographer bent on expressing his impressions of Nature may adopt in attaining his end are elastic, and are limited perhaps only by his own resourcefulness in contriving to modify and apply the technics of the process, as he has learnt them through chapters devoted to exposure, development, and the like. That a more or less complete mastery of technicalities is essential goes without saying. Unless one is born a genius (and the BARNET BOOK is not intended for such), one cannot render Beethoven or Mendelssohn until long after mastering the elements of music, or paint without learning how to mix colours, or speak and write without grammar; and for that reason this article on pictorial photography is placed last in the book. So now, in setting up the camera and looking on the focussing screen, or it may be looking into the finder of the hand

camera, we see the scene which for some reason or other we have selected. Now, to use a hand camera for pictorial work—and it may so be used—implies previous training with an instrument in which the image can be seen and *focussed whilst it is seen.* Having thereby learnt roughly the distance and lens aperture best suited for typical occasions, one *may* work with a focussing scale and guess-work ; but there must ever be a degree of uncertainty. The size of the camera matters not, nor its pattern nor the lens used, so long as we can see the image precisely as it will come on the plate and place the sharpest degree of definition precisely where we desire.

Supposing, then, we have racked out the camera so that the view is reasonably sharp ; the diffident one may ask, " What shall I focus sharpest, or what stop shall I use ? " So far as the lens stop influences the exposure, this is dealt with in the article on Negative-making, which comes first in the present volume ; but, so far as the effect which any particular stop produces, and the appearance attained by focussing sharply on one particular plane, or securing sharp definition throughout the picture, or, as it is termed, " depth of focus," the reader should have perceived by this time that it is a purely personal matter, one for individual taste and judgment to decide. The general suppression of sharp focus, the fuzzy picture, is not more artistically right than one in which everything is critically sharp, unless by such suppression an effect is obtained which could not be as well rendered by any other means.

It is veritably a case of the end justifying the means, and, whilst there is no rule, no question of right or wrong in the matter of focussing, it will perhaps at first be found expedient to avoid either extreme. As the principal object of the scene is naturally placed more or less

in the centre of the picture, and light and shade, as well as other objects, and the chief lines in the composition are, as far as possible, so arranged as to concentrate attention on that principal object, it will probably be but natural to first focus sharply upon it. We thus give it chief attention. Do this, then, with the lens at open aperture—that is, without any stop at all; probably objects beyond and those close to will be so confused and blurred as to be hardly recognisable, and if the picture were made like that it would be unpleasing, and the spectator would be made conscious of imperfection or incompleteness. Next try the effect of the largest stop. Suppose it to be *f*/8, and if this does not sufficiently clear away the regions of blur and confusion, try *f*/11, closely studying the altered effect on the ground glass, and determining thereby the precise degree of sharpness and depth best calculated to produce—what? A precise copy of all the facts and details in the view? No, certainly not, but that degree of sharpness which promises to suggest in the finished print the impression which the original produced in your imagination.

This may sound impossible until you begin to consider it more closely. For instance, suppose that one tree amongst the many which form a beautiful grove, by reason of its form, its light and shade, or some other character, attracts your notice and pleases you; instantly, for the time being, this occupies a central position in your thoughts; indeed, the entire universe is mentally grouped around it. Other trees, although as large and as distinct, are in your thoughts quite subordinated; you are conscious of their presence, but only in a vague sort of fashion. Hence, were you to focus all equally sharply, so that on looking at the print the spectator feels them all to be equally pronounced,

this will not give particular prominence to the one object which was chief in your imagination. This is but one rather crude example, but it may suffice to show what is here meant by making the picture realise the mental impression or imaginative idea. As a general rule, although, as has been said, there can be no fixed rule, it will be found best to focus most sharply on whatever object forms the principal theme—the *raison d'être* —of the picture, and let other objects, other plants, be just so much less sharp as shall cause them to be subordinate, yet not so unsharp as to make the want of definition immediately noticeable.

In landscape subjects, when we have perhaps an attractive foreground very close at hand which we wish to render well defined, but to do so and at the same time secure moderate sharpness in the rest of the picture would necessitate the use of a small stop, which possibly movement due to wind prohibits because of the consequent long exposure—in such case the swing back of the camera is a most valuable accessory. By swinging the top of the back outwards we may get the foreground quite sharp, as well as the distance, with even the largest stop. Similarly, a side swing is often useful when on one side of the picture we have a flowery bank or bed of reeds which come very close to the camera.

In all these matters of focussing the student must ever keep in mind that as the view appears on the focussing screen so it will be on the plate when developed. The character of the picture, the accuracy or otherwise of the rendering, is irrevocably decided when, having selected the front of view and focussed it, the lens is capped preparatory to placing the plate in the camera. The beginner too often appears to perform the necessary acts for the production of his negative according to set rules, possessed of a blind confidence that it will come all

right in the end, instead of which the ground-glass screen should be thoughtfully studied, and the questions asked of one's self, " How will that do ? Should the view be higher in the plate or lower—more central or less so, sharper here or more diffused there ? " Then, if the result be right or wrong, good or bad, you will at least feel that you have been personally responsible instead of having left the matter to blind chance and the accident of an unsympathetic machine.

In the matter of exposure you will be mainly guided by such knowledge of the craft as may be acquired by the perusal of some of the preceding articles in this book ; but if a wrong exposure will give you the effect you want better than what an exposure table tells you is correct, then give a wrong exposure by all means. Experience goes to show that a long or full exposure is best, by which means even the darkest shadows and blackest objects have time to produce some impression on the plate ; for in Nature there is hardly any such thing as an entirely empty space, for, if a shadow be so dark as to possess no detail at all, yet there is always a play of light reflected from the surroundings.

Quite apart from the actual objects which go to make up the scene, the composition often depends mainly on the contrast of light and dark colours ; it is hence of utmost importance that the plate used should be of such a kind that it will render the relative lightness and darkness of these colours precisely as they appear in Nature, and on this account an orthochromatic plate in conjunction with a suitable screen or light filter should be regarded as a *sine qua non*.

Remember that the part of the scene above the sky line—namely, the sky and its clouds—is as important as that which is between the foreground and horizon, and it were just as sensible to photograph the sky and leave

all the rest blank white as to photograph the landscape and leave out the sky ; supposing, of course, that the sky is included in the field of view ; and here we see how essential an orthochromatic plate is, for, if used with a suitable screen, the clouds, or, if there are none, then the clear sky, can always be correctly rendered on the same plate as the view ; and yet one hears of "sky and landscape on one plate" as though it were a great achievement. But if a landscape be rendered passably well, and the sky comes quite white, it follows that everything in the landscape of the same colour or tone as the sky has also been falsely rendered, though perhaps our perceptions are not sufficiently trained to notice it. Again, because in the brighter objects the intensity of light may be such as to obliterate the more delicate tones and detail, during a long exposure the backing of the plate is something more than a mere precaution—it is all but essential.

For all pictorial work, then, a backed rapid orthochromatic plate should be employed.

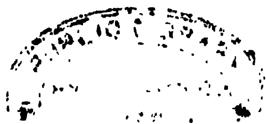
Develop for gradation and avoid any great degree of density. Just as a full exposure was given in order to prevent empty solid blacks, so one should in development keep the high-lights thin to escape rendering solid hard whites. The printing process to be used, the colour of the print, the shape and even the size, must all be determined by the effect desired and the capability of any particular process to give that effect.

The pictorialist is an autocrat, acknowledging no laws, using just so much of the possibilities of a process as suits him ; he must also be something of an experimentalist, trying this and that to see if it will yield what he desires. His field of operations is unlimited ; he may choose his subjects from anywhere, and, remembering that whatsoever pleases him or strikes his fancy, his

purpose is so to render it that his representation shall show others precisely what appealed to him, and why. The actual concrete objects included are to be merely the vehicles of his abstract ideas, and ate not depicted on account of any interest attaching to their existence. An artist may paint a picture which is a pure invention, having no real existence anywhere, and yet it will be not the less good artistically. The photographer must depend in the first place on realities ; but, if a picture and not a mere record is aimed at, then its value, and the pleasure it should give, are not dependent on the fact that a real place or subject is represented. Hence it follows that if it were possible to introduce into the picture something that was not present, but seemed likely more fully to express the idea, or if it were possible to omit that which is not desirable, it would be perfectly legitimate to do so ; and to some extent this may be achieved, not actually erasing, but by so printing that such parts shall be less obtrusive.

Having produced the negative in a manner calculated as far as possible to convey the impression desired, a very large amount of control can be exercised whilst printing from it. Screening the light for such parts as it seems fit should print lighter, and either removing the negative or not, letting the light operate on those parts of the print which by toning down will become almost obliterated—such methods for dodging or faking would of themselves form a subject for an entire chapter, and space in these pages is insufficient ; and hence the student is referred to books wherein these matters are treated of at length.

A. Horsley Hinton.



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